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NEW YORK INSTITUTE OF STOMATOLOGY.

A MEETING of the Institute was held at the Polyclinic College and Hospital, 216 East Thirty-fourth Street, Tuesday evening, February 4, 1896, at eight o'clock.

The vice-president, Dr. C. D. Cook, presided, and introduced Dr. R. H. M. Dawbarn, professor of Surgery in the Polyclinic College and Hospital, who gave a clinical lecture and surgical demonstrations, as follows:

Dr. Dawbarn.—I notice that the cards of invitation announce a large number of cadaveric demonstrations, and in order not to disappoint you I have also brought some living subjects.

This young man, twenty-seven years of age, developed a sarcoma of the nasal pharynx. Its attachment was partly from the middle turbinated bone and partly from the pharynx at the base of the skull. It was so extremely vascular—bleeding freely on the slightest touch—that another surgeon who was asked to operate on it declined to do so because he thought the patient might die under the operation. Before he came to my hands Dr. Lederman had made thirteen injections of antitoxine, prepared from the streptococcus of erysipelas and the bacillus prodigiosus. By the time he reached the thirteenth injection he declined to go on, thinking there would be a funeral; and, indeed, they had wofully sapped his patient's strength. There had been absolutely no benefit from this treatment; and there is hardly a doctor in New York now who has any confidence in injectional treatment

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save for the variety of sarcoma known as spindle-celled, and even that is *sub judice.* In the giant-cell and the round-cell variety antitoxine treatment proves absolutely useless, and it is a question whether in any other variety of sarcoma any better results are obtained by this method than from the injection of picric acid or of pyoktanin or methylene-blue. In this case the question arose whether I had a right to use the knife at all, because he bled so profusely. I started by tying both of the external carotids. You will notice that his neck shows a scar where I did that on each side. The operation was done last June, just before I went to Europe, and when I returned, in September, I found to my great delight that in the interval the tumor had shrunk to about a quarter of its former size from having almost its entire blood-supply cut off by ligation. If the circulation would only remain in that diminished condition we could expect a permanent shrinkage of the abnormal growth. The tumor remained small for two or three months further, and he said he felt better than he had for two years. Then it began to grow again from increased blood-supply, and it became a question of its removal. He consented to have that done as offering the only chance for his life. It was a desperate operation. I have never had quite as bloody a one, and that was a considerable surprise, because after having ligated the carotids we would not expect it. The hemorrhage was doubtless due to the fact that collateral circulation by anastomosis had been completely set up. The operation was done in this room three weeks ago. I will illuminate the mouth with this small electric light and show you the cavity. The incision runs from the prominence of the malar bone horizontally just below the orbit to the nose, thence along the naso-facial groove to the middle line, splitting the centre of the upper lip, and from this point along the roof of the mouth, at its centre, back to the soft palate, thence between the hard and soft palate on the affected side until the cheek is reached. The bone was partly sawn and partly chiselled along this whole length. The lower plate of the orbit was carefully preserved to maintain a support for the eye, which otherwise drops somewhat in the socket, producing a very objectionable form of diplopia. Upon incision of the growth the bleeding was very sharp. It came like pouring water from a glass. It was controlled by pressure of the fingers until the actual cautery could be applied. I now show you the tumor preserved in Müller's fluid; and here, too, I hand you the bones removed in this case. These are the entire superior maxilla (save its orbital plate), the palate bone,

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the entire right turbinated bones, and about one-half of the malar bone. When the flap is stitched together over this great gap the deformity, as you see, is remarkably trivial. With a good dental prosthetical appliance, including a plumper for the cheek, I think no one at a distance of six feet would notice that anything had been done. Furthermore, if there should be a recurrence it can easily be reached through the free bony gap which is left. It will be a question for you gentlemen to decide for this patient, who to-morrow leaves the hospital, how best a half set of artificial teeth may be supported, whether part of the pressure could be brought to bear during mastication upon a broad leg of hard rubber carried up to rest against the orbital plate.

To replace the blood that was lost, while the subject was still on the operating-table, we injected into a vein at the bend of the elbow over two quarts of water as hot as the hand can bear, boiled and filtered, and containing about a heaping teaspoonful of common table-salt to the quart. Also a little strychnine was used hypodermically. The conjunction of these two forms the best means of preventing shock in grave operations in which the hemorrhage has been considerable. The result of this injection of warm salt-water was simply wonderful. Before we began to inject it the pulse was 140, and when we had finished it was down to about 80. Five years ago I spent my spare time during an entire winter experimenting, in the Columbia College Physiological Laboratory, on dogs in this matter, injecting after the withdrawal of blood hot salt-water in various degrees of strength and heat. In one instance, my assistant and myself both forgot to put any salt in the water, he supposing I had done it and I supposing he had; we injected plain warm water, and the result was that the dog died almost as quickly as if prussic acid had been given him. Professor Curtis, of the college, said death was due to the fact that plain water has the power to dissolve out the coloring matter from the red blood, thus destroying the red-blood cells. The addition of even six-tenths of one per cent. of common salt prevents this bad result.

I want to show you the latest improvement in the Nitze electric cystoscope. I got this while in Europe last summer. It is used for the illumination of the bladder in searching for possible stone or possible tumors, and to determine whether pus is entering from either ureter. We will use it here to illuminate the pharynx of this patient whose sarcoma operation I have just described, and you will be able to see with the clearness of day the walls of the cavity, and how much is left of the palate and interior of the nose.

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We will also, later, use this electric-light cystoscope to determine whether there is or is not turbid fluid, such as pus, in one antrum of Highmore. In illuminating the bladder that viscus is first washed out and filled with water.

This next patient from my clinic is a woman from Germany. She tells me that she has had trouble that involved the upper jaw for a year past. She says that she herself removed with her fingers a piece of flesh from the region of the jaw last summer. I find a condition which is in all probability a malignant epulis. I would like to have the opinion of you gentlemen who have had more experience in that line than I have. There is now some gingivitis, an accumulation of tartar, some inflammation, and some recession of the gums. Several of the teeth are loose. The epulis occupies the region of the alveolus corresponding with the right upper canine, and extending back to the first molar tooth, evidently springing from the sockets of the canine and the bicuspid teeth. We shall excise a small piece of the growth, and be guided in determining how much of the jaw to remove by the pathologist's report as to its nature.

[NOTE.—It proved to be a giant-cell sarcoma, and a large part of the jaw was accordingly excised at Professor Dawbarn's next clinic.]

Now I will give you some demonstrations on the cadaver. The first thing on your programme that would be of much interest is a demonstration of the section of the lingual nerve for cancer pain. When you have cancer of the tongue to deal with, an operation is always indicated right away. If the patient comes to you early, it will probably be sufficient to remove one-half of the tongue, as the growth commonly begins at the lateral edge; and if you advise the removal of only one-half of the tongue, the patient will perhaps submit; but if the patient comes to you at a later stage, and you have to suggest the removal of the whole of the tongue, he will be likely to object, and procrastinate until it is too late to hope for cure. In excision of the tongue most surgeons deem it wise to tie the lingual artery. There is practically no anastomosis between the two lingual arteries; as shown by the fact that if you inject one side of the tongue through one of the arteries, with some blue coloring matter, for example, one-half of the tongue will be absolutely blue and the other half will remain red. The same statement applies to the lymphatics. For that reason cancer does not readily spread from one side to the other, and the early removal of the affected side will often suffice. If one lateral half of the

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tongue is to be excised, the preliminary ligation of one lingual artery will permit an almost bloodless operation. Even in case the cancer has gone so far as to make a radical operation hopeless, the patient's life can be prolonged for months by tying the lingual of the affected side, or, better, both sides, and thereby depriving the growth of much of its nourishment. And suppose a case comes to you so late that the cancer has already involved the wall of the pharynx or the buccal surface, and a radical operation is hopeless. The patient is suffering agony; every time he moves the tongue it gives pain, and also every time he attempts to speak or swallow, and there is excessive drooling of saliva. Here, by a simple operation that is absolutely safe and does not occupy more than ten seconds, this pain can be instantly relieved, without the taking of a particle of morphine, and that half of the tongue made so devoid of common sensation that a red-hot needle could be run through it without being felt. That operation is section of the lingual nerve. This we do by introducing within the mouth a curved, sharp-pointed bistoury, and making a cut against the ramus of the jaw running from a point three-quarters of an inch behind and below the grinding surface of the last molar tooth, to that tooth. This cut divides the nerve with certainty.

Now, perhaps, you would like a demonstration of the operation for the removal of a considerable portion of the inferior dental nerve for the relief of tic douloureux, a class of cases in which some doctors mistakenly advise the patient to have teeth out, and perhaps half the teeth in the lower jaw are removed without giving relief. I have seen several such instances, as have all surgeons. When medicinal means have failed a section of the offending nerve should be removed at a reasonably proximal point. We make an incision downward along the rear border of the ramus, then along the lower border of the body of the lower jaw, the limits of the incision being the facial nerve above and the facial artery below. There is no artery of any importance in this region. This so places the scar that it will hardly be noticeable. Next the flap is reflected from this incision, including the periosteum with it, which leaves the outer surface of the ramus absolutely bare. Now, as you see, I chisel away a strip of bone an inch and a half long from the ramus, exposing the nerve, which is about the size of a knitting-needle, where it runs downward from the inferior dental foramen on its way to the teeth and the mental foramen. As long a piece of the nerve is excised as possible. Some surgeons trephine

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instead of chiselling, and then replace the trephine disk, which, of course, contains in its substance a corresponding piece of the nerve, and turn that disk a quarter of a circle, in order to prevent the nerve redeveloping by any possibility along its canal. The flap is now replaced, the divided periosteum being stitched at the point of incision in order not to lose the value of the masseter muscle, which was reflected with the periosteum from the ramus of the jaw in the operation, but is now restored to its former place.

We now know that bone deprived of its periosteum will still live; and in trephining from the skull it is customary, if an aseptic operation is being done, to save the trephine disk, wrapping it in a warm, moist, aseptic towel until the operation is finished, and then replacing the disk upon the *dura mater*. In about fifty per cent. of the cases this bone lives. If it happens to be bone having very little cancellous tissue, a still better chance for its life will be afforded by chiselling it into a number of fragments, as it is nourished by capillarity from the surrounding plasma, and the shorter the distance of the capillary movement the better the nourishment.

In surgery upon the skull-bones there are several ways in which to attack them. One is to cut our way through with a coarse bur in the dental engine. Another is the rongeur forceps. Our German friends almost always use chisels or gouges. That is all right in very cautious hands, but in brain-work it would be a trifle late to apologize after the gouge or chisel had slipped. And the constant jarring adds to the shock. If you use the chisel in the tic douloureux operation you press against the jaw so as to prevent as much as possible the jarring of the joint. Yet another method is to use a trephine, as I have described.

I shall now show you the anatomy of the ligation of the lingual artery. I shall demonstrate that ligation in two minutes, and—not to waste your time—will make a rapid sketch of its relationships. [Dr. Dawbarn here illustrated his operation by a drawing with colored crayons on the black-board.]

This is one of the arteries that you can always depend upon to be where it ought to be. I have demonstrated it now eleven times on living subjects, and nearly three hundred times on the cadaver, in my operative surgery classes here; and I think those surgeons who during operation think they have found anomalies in the course taken by this artery have simply not gone where they ought to have gone.

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Now, I shall ask you gentlemen, if you care to do so, to compare this dissection with the sketch that I have made on the black-board. Here is the posterior tendon of the digastric, here the anterior tendon of the digastric; here is the mylo-hyoid, which is drawn on the board in blue; here is a portion of the hyo-glossus, shown there in red. The twelfth nerve passes across and disappears under the mylo-hyoid, as in the sketch. Before I destroy this I will show you, by cutting through the hyo-glossus, the position of the artery running up towards the tongue. As you know, every artery in the dead subject looks flat. That is the only artery of any size in that region. It looks flat, even appears a little grooved; but during life, being full of blood, looks cylindrical. I shall also show you with the needle the channel in the artery.

Nasal hemorrhage is something that we all ought to know how to treat, and it is inadvisable to wait more than a moderate time, trying the various remedies that may possibly succeed and are quite as likely not to succeed, before using means that are absolutely certain. Such a case (save the excessively rare contingency of hæmophilia, which one may not see in a lifetime) can always be controlled in two minutes' time, to an absolute certainty. In mild cases we first gently plug the interior of the nose on the bleeding side with gauze, or a strip of handkerchief, soaked either in peroxide of hydrogen, a saturated solution of antipyrin, or dampened with a weak solution of cocaine up to five per cent. If these fail, then the scientific thing to do is to look for the cause of the bleeding, which is generally found in the anterior portion of the septum nasi, where, with a good light, blood will be seen trickling from the artery. By means of a metallic point, heated nearly red-hot and applied to the surface, it may be cauterized, and the bleeding checked almost at once. In the rare contingency where the bleeding-point is so far back as not to be seen with the aid of a forehead-mirror and reflected light we can always control the hemorrhage instantaneously by tamponing the nares. If the anterior naris is plugged, the posterior should be also, because otherwise the blood may continue to flow into the pharynx and be swallowed, the patient not realizing how much blood is being lost. In most works on surgery a Bellocq's canula is figured; I don't know why, because it is a needless instrument for this purpose. All that one needs for tamponing the anterior and the posterior naris is an ordinary soft-rubber catheter, such as is used for drawing urine. As you see, I now pass this through the nostril on the

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affected side, and presently its point appears in the pharynx. Seizing this with a pair of thumb-forceps, or a dressing-forceps, it is drawn out of the mouth; so that now one end appears through the nose and the other out of the mouth. Upon one of these ends we now tie a doubled piece of soft twine, say a yard long, and by completely withdrawing the catheter the twine is drawn into place; so that now we have the doubled twine entering the nose and escaping at the mouth. Upon the middle of this doubled twine we tie our posterior plug, folded from a piece of handkerchief, about the size of a large marble, and draw it into place. The anterior plug, much smaller, is now tied in place, aided by the doubled twine, and we are able to do this more tightly than we could have done with a single piece of twine. Now, the front and the back of the nose being absolutely closed, and connected by a tight string, all the blood that can flow will be the small amount which may fill one-half of the nose. The loose ends of string coming from the mouth and nose are tied together.

Such a tampon is left in place twenty-four hours, and the patient is warned not to try to blow out the blood-clot subsequently. This method of tamponning is much less annoying to the patient, uncomfortable though it is, than to insert a rubber or other sheath into the nose, and distend it with either water, air, or a gauze packing. The interior of the nose never was meant to be subjected to any other pressure than that of the atmospheric air. By the first method of tamponing, the very sensitive turbinated bodies are not subjected to pressure; by the second method, which I have just said is extremely uncomfortable, they are subjected to a direct pressure, which is why I disapprove of it. The patient should be sitting upright. If you use a little cocaine spray, the operation is hardly annoying at all. As to how firmly we draw this rear tampon into place, a good rule is to draw it just for a moment with almost force enough to lift the patient's head by it. If peroxide of hydrogen is used, an objection to it is that it is irritating. In a certain case where I applied it for the purpose of dissolving the membrane in diphtheria, after I had used it two or three times my patient told me she preferred the diphtheria. Its irritating quality is due to a free acid, usually hydrochloric, which is put in by the makers to prevent the tendency of the excess of oxygen—which oxygen alone renders it of value as an antiseptic—from escaping. On account of this free acid it is very irritating to the membranes. If you will take a sample of any peroxide of hydrogen in the market, and touch a little of it to the conjunc-

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tiva of your eye, you will not wish to repeat the experiment. I make it a rule to neutralize all peroxide of hydrogen before use by putting a little ordinary soda bicarbonate, pinch by pinch, into the amount of peroxide which I intend to employ at that sitting, until it no longer effervesces, when the free acid is neutralized. The peroxide itself will remain for a short time just as efficient as before for the purpose for which we employ it.

Dr. McNaughton.—Has not pyrozone the same objection?

Dr. Dawbarn.—I am not certain about free acid in pyrozone. It may be so. It could be readily ascertained by testing with litmus paper.[1]

If you should meet with a severe case of nasal hemorrhage where even a soft-rubber catheter is not to be had, a twig from a willow-bush, or a stiff shoe-string, with twine and a bit of handkerchief, will answer the purpose for tamponning. The operation is even more easily done on the living subject than on the cadaver.

Œdema of the glottis is an accident that is so rapidly fatal if unrelieved, and yet so safely curable if treated properly, that every oral specialist should be familiar with the proper technique. It may be remembered that the U. S. Minister to Russia, first appointed during President Harrison's administration, died at the Fifth Avenue Hotel, in this city, while *en route* to Russia, of a sudden development of this trouble, in the absence of a doctor. Had a doctor been on hand, his life could have been saved to a certainty. It is a condition in which two large dropsical bags, covered with mucous membrane, develop on either side at the top of the larynx, and nearly or quite meet in the middle, thereby obstructing the respiration. The pathological condition is an acute inflammatory distention, with serum, of the ary-epiglottic folds. Now, if we take a curved, sharp-pointed bistoury, and wrap it with string or adhesive plaster down to within a quarter-inch of its point, we may safely guide it by the left forefinger, passed into the mouth and behind the tongue, which feels these bags of water, and cut them freely on either side, causing immediate relief. There is no operation that is simpler than this one for the relief of œdema of the glottis.

The next operation will be one that is of interest to every one, —namely, how to relieve that accident which is the source of occa-

[1] This test was subsequently made; it is acid.

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sional fatality, choking to death from "swallowing food the wrong way." It generally occurs while laughing or talking and at the same time endeavoring to swallow. A morsel of solid food enters the larynx, and is caught at the narrowest point,—the chink of the glottis (rima glottidis). If a medical man is present, it would be a lasting disgrace to him should the patient die, for relief may be obtained in a moment, with a single cut of a pen-knife in a perfectly safe region. This I will now demonstrate. You will observe that when the head is thrown back there are two prominences of the larynx, easily distinguishable by sight or touch. The uppermost is the so-called "Adam's apple," the lower is the inferior edge of the larynx, or cricoid cartilage. Between these is a small depression, into which always the tip of the finger may be made to sink. This depression, the crico-thyroid space, is where the cut should be made; guarding the pen-knife with the finger and the thumb so that only a quarter of an inch of the blade is permitted to cut, and with a single thrust, cutting horizontally, this crico-thyroid membrane is opened, and we enter the free air-space beneath. We cut horizontally because thereby, as I now show you upon this papier-maché model of the larynx, the space is wider transversely, and we thereby get more room, and also the crico-thyroid artery is less likely to be divided. At once the patient can inhale freely; and now through the cut we introduce some blunt instrument, like a lead-pencil, a hair-pin, or even a match, and dislodge upward the food which has caused the trouble; the patient can then cough it out. The operation is not tracheotomy, but laryngotomy. The only blood-vessel there is the little crico-thyroid artery, and that, if cut, can easily be controlled with the finger.

Dr. Bogue.—Can Dr. Dawbarn tell us something about that rather recent instance in which a cork was drawn into the trachea, and an operation performed for its removal?

Dr. Dawbarn.—That was a case in the practice of Dr. Fowler, of Brooklyn. A minister inhaled, while laughing and talking, a cork that he had just drawn from a medicine-bottle with his teeth; this cork passed beyond the larynx and into the windpipe, and he allowed some hours to elapse before calling in surgical assistance. At that time the cork was found lodged in one of his primary bronchi. Tracheotomy was done, and an attempt was made by Dr. Fowler, with a most ingenious instrument on the corkscrew principle, to extract the cork; but the mucous membrane had become so swollen from inflammation caused by this foreign body as to hold it firmly and render its extraction impossible. A portion of

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the cork did come away, but the remainder proved not removable, and the patient had to die with it in. Dr. Fowler attempted, after failing from the front, to attack the rear wall of the thorax, but he found it an extremely bloody and dangeous road, and had to give it up.

Dr. Bogue.—How far from the vocal cords do you cut in the laryngotomy which you have just demonstrated?

Dr. Dawbarn.—The vocal cords are almost mathematically in the middle of the larynx, measuring from top of thyroid cartilage to bottom of cricoid cartilage. The space we enter is well below the middle, and hence below the vocal cords, and below the food caught between them.

For the reduction of a dislocation of the lower jaw the usual plan is to depress the rear part of the lower jaw while lifting the anterior part, making the thumbs, wrapped in a handkerchief, a fulcrum. As soon as the articular condyle is forced below the eminentia articularis the temporal muscle will at once draw the lower jaw back to its normal place. Sometimes stout corks placed between the molar teeth are used instead of the wrapped thumbs. In one case in my experience, sent to me by a doctor in Bridgeport, the patient for some months had had an irreducible double forward dislocation of the lower jaw. Reduction had been attempted in the usual way by several excellent surgeons, among them Dr. Bacon, of New Haven, the patient being under general anæsthesia meanwhile; therefore I did not waste time in repeating these efforts. Instead, I made two incisions horizontally just below the zygoma, exposing the articular condyle in its false position; and then, by introducing a stiff instrument and using leverage against the tubercle of the zygoma, I succeeded in accomplishing the reduction. Of course, leverage had to be applied on both sides and through both cuts. The result was excellent, only two thread-like scars now showing that anything had been done. This operation is an exceedingly rare one. Hamilton "On Fractures and Dislocations," for instance, does not even allude to the possibility that a cutting operation may be needed in old cases of this difficulty.

Dr. McNaughton.—After three or four years had passed would it be possible to reduce such a dislocation?

Dr. Dawbarn.—It would be possible by means of a cutting operation, but not otherwise, because the temporal and other muscles of mastication would have become very much contracted in the new position of the jaw.

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The scientific way to make a diagnosis of suppurative disease of the antrum is by the aid of a small electric light introduced within the mouth, the room being meanwhile dark. The tissues of the front part of the face are thereby made translucent and illuminated. On the affected side, however, the antrum being partially filled with a turbid fluid, pus, this somewhat obstructs the rays of light, and that side of the face will be comparatively dark. The difference is striking enough to be seen even from a considerable distance. The less scientific way of making the diagnosis is to have the patient first use the handkerchief thoroughly, and then lie in such a position that the antrum can drain by its natural opening into the nose. If, after a very few minutes with the head in this dependent position, a considerable amount of muco-pus may be expelled from the nostril on this side by blowing, the diagnosis is very probable; especially so if in conjunction with the presence of pain and tenderness and some swelling of the soft parts of the front of the face over the antrum. The treatment of this condition, which is often not recognized, and is attributed to neuralgia or to dental difficulties, is extremely simple,—one of the simplest in oral surgery.

There are several routes whereby the antrum may be entered and the pus drained. It will be evident that some artificial entrance must be made, because pus, like any other fluid, will not drain up hill, and the natural opening of the antrum is at the junction of its roof and inner wall, so it would be necessary for a man to stand on his head to drain it that way. We must therefore attack its floor for permanent drainage. One way in which this can be done is through the inferior meatus of the nose on the affected side. A second way is by extracting a tooth, and drilling up through its socket. This latter method has always seemed to me not only needless, but distinctly objectionable, inasmuch as a tooth that is even partially sound is too good a friend to be lightly sacrificed. The simplest way, and the best, in my judgment, is the one I now demonstrate for you,—namely, to make, under cocaine anæsthesia, an incision about an inch in length, extending from behind the canine tooth, backward along the junction of the gum with the cheek. The superior maxilla is then exposed just above the alveolar process. The bone covering the antrum is here so thin that the lightest tap of any steel instrument will readily penetrate it. It is almost as thin as a sheet of paper. And the cavity extends for such a distance above the bicuspid and molar teeth that no one could fail to find it. The ordinary dental engine would,

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with a coarse bur, give you entrance at once; or, if preferred, one may use, as I am now doing, a small gouge or chisel. An opening the size of the base of a lead-pencil is made, and through this the pus is washed out, some of the fluid escaping by the nasal passage into the nose. Preferably the peroxide of hydrogen is used once or twice daily for such irrigation. Following the washing, a short piece of rubber draining-tube is introduced, say half an inch in length, and is attached by a thread to the periosteum or the mucous membrane near the artificial opening. This tube is left in place until the discharge ceases. The advantage of this high incision, which nevertheless enters the floor of the antrum, is that the lip falls over this small tube in eating, and there will not be much likelihood of food making its way up into the antrum; whereas if a tooth is extracted, and the entrance forced through its socket, every movement of mastication tends to force food directly upward where we do not wish it to go. In certain very chronic cases we may have at a later stage to enlarge the bony opening, and with a sharp spoon scrape away the diseased mucous membrane, and sometimes the carious bone which in such cases may be found. Such chronic cases do best when treated by packing daily, or on alternate days, with a long slender strip of iodoform gauze until all discharge has come to an end. I will now show you here what a large cavity the antrum is; with this bent probe you may examine its walls in all directions.

Dr. Bogue.—If the antrum is small, you simply make the opening farther back.

Dr. Dawbarn.—Yes. If not normally placed, the cavity is rather farther back than forward. I understood Dr. Bogue to say just before this lecture that he wished some questions answered in regard to cocaine. I will answer the questions now, if I can.

Dr. Bogue.—How do you use cocaine in this operation for antrum disease? After speaking of that please state a few general facts regarding the use of this drug in surgery.

Dr. Dawbarn.—I make a fresh solution every time, in the first place. You can get the tablets, half a grain or a grain each, and dissolve one in a little water. The trouble with a solution that you keep on hand is that it is not antiseptic at all. After it stands two or three weeks, if you examine it, you will find it reeking with microbes. Of course you can avoid that by adding carbolic acid in small amount (say one per cent.) to your solution, which will then

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keep well. Do not use bichloride of mercury, however, to prevent microbic development in your cocaine solution, for this is chemically incompatible with the cocaine, which will at once be precipitated as a white, milky deposit. I believe one grain of cocaine injected to be perfectly safe in a person in fair health, although there has been a case recorded where one grain was fatal; a case of a weak old lady, operated upon for ectropion. I have not heard of any fatal case from this dose excepting that. Occasionally you hear of some unfavorable symptoms from absorbing one grain, and it is well to use not more than two-thirds or three-quarters of a grain. When cocaine kills, it kills by contracting the blood-vessels of the brain. Respiration first fails from acute anæmia at the respiratory centre. The heart beats rapidly and weakly, but only stops after respiration fails. That being the case, if you will use something that will dilate the blood-vessels you will prevent and obviate the ill effects. For this purpose glonoin may be used, which is a one-per-cent. solution of nitro-glycerin in alcohol. You can get it in tablets. One to two drops of a one-per-cent. solution is a safe dose. By dissolving a little glonoin with the cocaine solution the ill-effect will be obviated. I should say that one or two minims would correspond to half a grain of cocaine. Perhaps the simplest way to prevent possible cocaine-poisoning is to give the patient a good drink of whiskey at the same time with the cocaine. Whiskey also tends to dilate the blood-vessels and to stimulate the heart. It is, moreover, somewhat anæsthetic also.

Dr. Allan.—In case you had this bad effect of cocaine, would it be proper to administer whiskey?

Dr. Dawbarn.—Yes. But after having the patient lie flat, the most rapid stimulant you can use is aromatic spirits of ammonia, one or two teaspoonfuls in a half glass of water. You need not be afraid of killing the person with that or with whiskey. Every one has noticed that in coryza you cannot breathe through the nose. In such a case if you snuff up a little cocaine solution it will immediately restore the breathing capacity, and in five minutes your nose will be as free as if there was never any such a thing as cold in the head. The nasal passages will be perfectly clear. Nevertheless, it is of no real benefit, because it only temporarily contracts the blood-vessels, and the swelling soon comes back worse than before, and lasts all the longer because you have done it. I only mention that as showing the marvellous power cocaine has of contracting the blood-vessels, and that is the way it kills. By the way, disease of the antrum almost always begins with coryza. A

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cold in the head continues for some time, the mucus gets thicker, the patient's cheek begins to ache, accompanied sometimes with fever and rigors.

Dr. Allan.—Does whiskey interfere with the action of cocaine?

Dr. Dawbarn.—No, not at all. It just occurs to me to say a word about pronunciation. The tendency is to pronounce this drug *cokane*,—a two-syllabled word, but it is properly pronounced co-ca-ine. A curious thing about this alkaloid is that its effects are only centrifugal; it travels centrifugally along the nerves. That is why it is so ineffectual in dentistry, as you apply it in a cavity to the distal end of the nerve.

Dr. Bogue.—Is the effect on the lower portion of the nerve due simply to the drug being carried through the blood, or is there an absolute transmission in the nerve itself?

Dr. Dawbarn.—The latter is the case when the circulation is cut off temporarily. This is easily proved by injecting cocaine in contact with the ulnar nerve behind the elbow, the circulation being meanwhile shut off by a tourniquet. In a short while the little finger and half the adjacent one become completely numb. You do not, however, have the same benumbing of the nerve in a centripetal direction from the point of injection. The explanation can hardly be a destruction of conducting power of the nerve at the point of injection,—as one might divide a telegraph-wire and thus break a circuit,—since its power returns promptly when the circulation is restored and the cocaine thus washed away. In dentistry you can benumb an upper central or lateral incisor by taking a little pledget of cotton and soaking it in a ten-per-cent. solution of cocaine and putting it in each naris close to the roots of the incisors, and leaving it ten minutes. You can then extract or fill the central or lateral incisor with almost no pain at all. I have tried it on myself, and know. It reaches the nerves of these teeth at a proximal point, so that the anæsthesia can travel centrifugally. The nerve is benumbed, in other words, before it enters the root of the tooth.

Dr. Bogue.—Apropos of this use of the electric light for the purpose of making a diagnosis of disease of the antrum, it may be proper to say that light has also been used for determining the existence of death, a prize having been paid a doctor in Paris several years ago for a demonstration that whereas during life a bright light shining through the flesh between the closed fingers presents a pink hue from the circulating blood, after death the light shows no such pink hue, but an opaque appearance.

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Dr. Dawbarn.—That is new to me. I had not heard of it. It is a very interesting fact, and I should like to try it.

On motion of Dr. Bogue, a vote of thanks was unanimously tendered to Dr. Dawbarn for his very interesting lecture and instructive demonstrations.

Dr. Cook.—Dr. Lord, our president, wished me to express his sincere thanks to Dr. Dawbarn for his kind attendance here this evening. Dr. Lord was compelled to leave early in the evening. Dr. Dawbarn has given us a most enjoyable lecture, and his demonstrations were the finest I have ever had the pleasure of seeing.

Adjourned.

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A MEETING of the Institute was held on Tuesday evening, March 3, 1896, at the house of Dr. C. O. Kimball, 27 West Thirty-eighth Street, the Vice-President, Dr. C. D. Cook, presiding.

The minutes of the last meeting were read and approved.

The Chairman.—We are able to give a few minutes to communications on theory and practice. Has Dr. Allan something to say?

Dr. Geo. S. Allan.—Some time ago, when I was in Boston, my friend, Dr. E. H. Smith, showed me a series of plates that were designed by his father-in-law, Dr. Shaw, for spreading the upper and lower jaw in regulating. I have tried them in my own practice, and they have been so successful that I begged Dr. Smith to send me on a complete set of the plates so that I might show them this evening. The plates really explain themselves, one being for the purpose of spreading the anterior part of the upper jaw only, as in the ordinary V-shaped mouth, while another one will spread the entire arch. The plates are operated by various little screws, and the force is a positive one; the process of widening the jaw goes on without special inconvenience to the patient, and without the slightest risk of a set-back or loss of time. The amount of pressure can be regulated with the utmost nicety. The same principle is applied to the lower jaw, except that with the lower plates he uses a spring which is detached from the plate. These plates were referred to and partially described by Dr. Shaw in the *Dental Cosmos* for April, 1888.

The principle, I am convinced, is one that can be applied with success in almost any case where spreading of the jaw is required, and in my experience is vastly superior to the Coffin split plate, which I have used a good deal in the past.

Dr. C. A. Woodward.—Does Dr. Allan think the principle upon which these plates are based superior to the Jackson method?

Dr. Allan.—I do not think the Jackson method is equal to this. The fulcrum, the base of support, is better, and the pressure can be better regulated.

I have another little matter to which I wish to call attention. After a gutta-percha filling is placed in position it is often a matter of a good deal of difficulty to trim off the portions which overlap the margins of the cavity. The ordinary way is to take a warm instrument and cut it off. But that has its difficulties, and it is not a practical way at all times. I have been in the habit for some time of using little knives for that purpose. These knives fit into a socket-handle, and one can go around the neck of the tooth with

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them and reach almost any position to trim off the superfluous material in much less time than it would take with a warm instrument, leaving also a clean-cut surface. These four sickle-shaped knives constitute the set.

Dr. C. O. Kimball.—I would like to call attention to a plan for the registration of operations upon cards, somewhat similar to the card catalogue of a library.

Each patient has a card about nine by seven inches, with diagram of the mouth and numbered spaces for dates, a column of spaces being reserved for records of "cleansing." The operation is noted on the diagram, a single figure referring to the date.

The cards, arranged alphabetically, are kept in the drawer of a case made for the purpose, which is fixed to the wall close to the operating-chair. When work is begun for a patient, this card is taken from the drawer and placed, also in alphabetical arrangement, in a small desk at the top of the case, and kept there till the series of appointments is completed. When each patient comes into the room his card is turned down so that a complete record of all my operations for him lies before me while at work.

Operations on the temporary teeth are noted on a paper diagram temporarily attached to the card, which can be removed and destroyed when the temporary teeth have all been replaced by the permanent ones.

I have had this system in practical use for over twenty-five years, and have proved its value in many ways.

Dr. W. St. George Elliott.—I would like to ask Dr. Kimball whether there are not some objections to the card plan of keeping professional accounts. Several years ago I adopted a similar plan, my cards being larger, however, and the diagram of the teeth was on two horizontal lines The rest of the card was arranged on a plan I had used a number of years, the main feature of which was a three-inch line for remarks for each operation. While practising in London I kept very full accounts of each operation, nature of the case, kind of filling material, kind of mallet, etc. I had expected to draw up some sort of a table, showing the advantages of certain modes of treatment, etc., but retired from practice before I had made any use of the eleven years data. When I re-entered practice, over a year ago, I adopted the card system as an experiment, but was not altogether satisfied with it. The main objections are cost, cumbersomeness, and liability to misplacement; they are not so well adapted to the profession as the usual ledger. I will admit, however, that they have some marked advantages,

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the principal being, having a card before one instead of a large book, and the ability to withdraw from the lot of cards those of patients who have died or have gone away, a very material advantage.

Dr. Kimball.—The system is very simple. It is merely the record of the work, the accounts being kept in another place. The cards are placed alphabetically in a drawer, and kept there. A card is taken out from the drawer and put in the small desk when the patient first comes, and is returned when his work is completed. I have never adopted the keeping of records as fully as Dr. Elliott has stated. My record shows the general kind of operation, what the filling was, when it was put in, and its shape in relation to other fillings, principally for the sake of identifying the work, watching my work, and knowing how it stands. If there are any details which I wish especially to note, as any peculiarity in the filling or operation, I do so upon the margin or back of card. I will exhibit the cards.

Dr. Elliott.—In starting a new society, we are naturally ambitious to take a higher position than most societies, and I do not know of any way that would tend to so much usefulness or draw so much attention to our work as to have our papers and remarks properly illustrated. An outline drawing is quite sufficient and is not expensive.

Dr. E. A. Bogue.—Something that one of my patients said the other day interested me so much that I would like to repeat it. It is this: "That phosphate filling that was put in for me the other day—after being stearinized or paraffinized—felt smooth just like gold, and had none of the acid taste that such fillings have for a day or two. It is the first time a phosphate filling has ever failed to give me annoyance, although I have had a good many put in my mouth."

The Chairman.—I would like to ask if that bad taste occurs when the phosphate has been properly ground.

Dr. Bogue.—This lady had had phosphate fillings put in anywhere and everywhere. I do not know how they were done.

The Chairman.—I will now call on Dr. J. Morgan Howe, the chairman of the Committee on Materia Medica and Therapeutics, to make a report for his committee.

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NOTES ON FORMIC ALDEHYDE.

BY J. MORGAN HOWE, M.D., M.D.S., NEW YORK.

Having been appointed by the president of this Institute a member of the Committee on Materia Medica and Therapeutics, these notes on this comparatively new therapeutic and prophylactic agent will be presented as a partial report from that committee, with the understanding that the other members will make additions to it during the discussion of the subject.

As this substance has already been shown to have very valuable properties for our service, it is well worthy of our study. The results of my own use of it during the past year have been so favorable that I have looked somewhat into its chemical characteristics, and its literature. These have increased my interest in it, and have helped establish the conviction that it is destined to be of great service to us in several ways.

Formic aldehyde, or formaldehyde, is a gas, prepared by subjecting methyl alcohol (or wood alcohol) to oxidation. The chemical formula of methyl alcohol is CH_4O, of formaldehyde is CH_2O, and of formic acid is CH_2O_2. It is a product midway in the process of oxidation, between the alcohol and the acid. The first step in the oxygenizing process is effected by the loss of two atoms of hydrogen, and this change is expressed in the word aldehyde, contracted from *alcohol dehydrogenatum*. The next step in the oxygenizing process, which forms the acid, is effected by the addition of an atom of oxygen, as is seen by the formula.

As this gas is readily absorbed by water it is furnished to us in a forty-per-cent. solution, and in this condition is known also as formalin and as formol. As formalin is quite commonly used as a designation, and is, perhaps, a trifle more convenient, it is not objectionable, excepting its tendency to cause the chemical constitution of the compound to be lost sight of; for aldehydes, being as regular chemical compounds as alcohols or acids, are entitled, as such, to have their regular designations remembered. For this reason I have chosen to use the chemical name at the head of these notes.

Formaldehyde in solution, as we obtain it commercially, is comparable in a way to the solution of ammonia, with which we are all so familiar,—a gas absorbed by water, and capable of being diluted with water to any extent, so that any desired percentage may be obtained in that way.

Although its antibacterial action was noticed by Löw in 1886, it

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has only begun to attract much attention during the last two or three years. Berlioz and Trillat have demonstrated that anthrax bacilli were killed by a dilution of 1 to 50,000, and Drs. Slater and Rideal have shown that the growth of different specific micro-organisms was inhibited by its addition to the media in the proportions of 1 to 5000 up to 1 to 20,000; and soiled cloths from the post-mortem room were rendered sterile by soaking in a one-per-cent. solution.

A one-half-per-cent. solution has been used in surgical operations for irrigating wounds and washing the hands and instruments of the operators, with better results than when other antiseptics were used for those purposes, and it has been used in a similar way in ophthalmic practice. Dr. J. M. Davidson, of England, has recently reported very favorable results from the use of solutions of 1 to 2000 and 1 to 3000 in abrasions of the cornea, and in hypopyon ulcers. It prevents suppuration and relieves pain, producing no irritation in the strength recommended, according to his experience. Whooping-cough has been successfully treated by spraying a one-per-cent. solution over the heads of the patients; and experiments are being made similarly in the treatment of pulmonary consumption.

In bacteriology formaldehyde has been found of great service in the arrest and fixation of development, at any desired stage; and for preserving and hardening anatomical and microscopical specimens it has served the purpose better than either alcohol or Müller's fluid.

This agent has been proved to have such extraordinary disinfecting power, together with non-toxic qualities, that one-half-per-cent. solutions are recommended as fully adequate for the general disinfection of sick-rooms, infected clothing, books, and furniture, by means of spraying apparatus; and for the disinfection and deodorization of vessels, closets, waste-pipes, etc., and their contents, by simply pouring over them. A one-per-cent. solution has been found amply sufficient for almost all disinfecting requirements, and from one-fourth- to three-fourths-per-cent. solutions are strong enough for most purposes. In these latter dilutions Professor Cohn has found it capable of preventing the development of the bacteria of putrefaction, and aqueous infusions thick with bacterial life were cleared by such additions, the dead bacteria sinking gradually to the bottom, and the offensive odor disappearing.

Formaldehyde has been used to some extent as a preservative of milk in Great Britain. It has four times the potency of any other

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antiseptic commonly used for that purpose. Four or five drops of the forty per cent. solution has prevented the souring of one hundred cubic centimetres of milk for six weeks. If it has been used for such purposes in this country, the fact does not appear to be generally known, for it was not mentioned by physicians discussing the adulteration of milk, at a meeting specially considering that subject, held last January, in the New York Academy of Medicine.

My attention was first called to formaldehyde, or formalin, by the remarks made by Dr. Louis Jack at a meeting of the Academy of Stomatology, and reported in the INTERNATIONAL DENTAL JOURNAL for March, 1895; in which he related the cure of a pulpless, irritable tooth, that would not bear stopping up, by means of two applications of this remedy. It appears that Dr. Kirk had spoken of this substance to Dr. Jack. He having learned of it from Dr. Mascort, who had treated indiscriminately many cases of alveolar abscess with it, at the St. Louis Hospital, and was quite enthusiastic over its use "as a root-dressing for putrescent cases."

On March 28, 1895, Miss B. (an invalid) called for the treatment of a lower bicuspid that was pulpless, and in that peculiar, irritable condition that will not endure the occlusion of the pulp-canal. The family had been my patients for some years, but this member had been referred to another dentist nearer to her home, because her poor health prevented her from being certain of ability to keep appointments, and this particular tooth had been—at the time of her call—under treatment for three months. The tooth was treated for several days before I recalled the reference to formalin I had read nearly a month before, and during this time various remedies were used with some apparent benefit at first, but later with renewed increase of irritability.

At this time, when convinced that I had gained nothing by what I had done, I looked up the record and obtained some formalin in five-per-cent. solution. The first application was made on cotton in the root-canal, and covered with cotton saturated with sandarach, so that the patient could remove it if necessary. She caught cold next day, and sent word she could not keep her engagement, and I did not see her for nine days. When she called again the dressing was *in situ* as I had placed it, and she had felt no discomfort from it. I renewed the dressing, covering it this time with a temporary gutta-percha stopping, and six days later the root was filled with oxychloride of zinc. This tooth gave no trouble after the first dressing of formalin was placed in the root-canal, and has continued perfectly comfortable and useful until the present time.

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I have since had several similar cases to treat, and the application of formalin in five-per-cent. solution has been successful in all but one. The key-note of the remarkable and unique influence of this remedy is struck more clearly, I think, in this particular class of cases than in any other. No other medicament that I know of has such an effect. In the case described at length above, the other dressings used were impotent to enable the tooth to bear occlusion of the vent for more than a few hours at the best.

The exceptional case referred to was a cuspid that had been open and discharging slightly for several years, and careful examination convinced me that there was an opening through the side of the root near the apex.

Since using formalin successfully in the first one or two peculiar cases already referred to, I have gradually used it more indiscriminately in the treatment of pulpless teeth, without fistulæ, and have found it peculiarly and wonderfully effective in disinfecting them, and removing all tendency to irritation from admission of air, or efforts to cleanse and prepare the root-canals, or from subsequent filling of the roots.

After considerable use of this substance, I discovered that it was possessed of decided deodorizing power, before I had consulted its literature sufficiently to find that this quality is claimed for it, as has been noted above. In one recent case in which I tested it, an offensive molar was treated in the root-canals with electrozone, without removing the bad odor, but a two-and-a-half-per-cent. solution of formalin made it quite free from all offensiveness in a few minutes.

I have not used it in the treatment of alveolar abscesses with fistulæ, but have tested its efficacy a few times in pyorrhœa alveolaris, and found that it seemed to have no special influence to diminish the formation of pus. My judgment of its therapeutic influence on tissues, to which it is applied, is that its special sphere is to allay irritability of the tissue and prevent inflammation and suppuration. It may have greater influence in reducing suppuration, and in favoring a return to normal conditions after pus has formed than I have discovered, and I hope that something more definite on this point will be reported in the discussion of this subject.

It is a powerful irritant, and the warning that Dr. Jack gave in the record before referred to—that is, that it should not be used in greater strength than a five-per-cent. solution—may well be heeded. Its application in root-canals in that dilution will sometimes cause pain, and I have even found it to give evidence of irritation in a

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two-and-a-half-per-cent. solution. But the pain has always passed away in an hour or two, when the dressing was left in the tooth, and has ceased in a few moments after the removal of the dressing, in those cases that caused complaint at the time. These evidences of irritation have been only in exceptional cases, and I have concluded, from my clinical experience, that it is most likely to cause pain when it is applied in the root-canals of teeth whose pulps have been recently destroyed; for which other dressings would have been better. The inference is that its irritating properties are overcome by chemical action when it is brought into contact with putrescent matter. In my recent use of formalin I have found a two-and-a-half-per-cent. solution answer the purpose so well, both as a deodorizer and disinfectant, that I am inclined to believe that a stronger application is unnecessary. I have disinfected many putrescent pulp-canals with this substance in the two-and-a-half-per-cent. as well as the five-per-cent. solution, and filled the roots at subsequent sittings without the use of any other agent whatever for treatment, and have had remarkably satisfactory results.

In two cases only pain and swelling to a very limited degree followed the filling of the roots, and this I attributed to my own or the patient's anxiety to get the work finished, and off the list; being due rather to an error of judgment in filling too soon than to lack of efficacy in the formalin dressing. Formalin has some coagulating action on albumen, which is apparent even in the action of the two-and-a-half-per-cent. solution a few minutes after its contact with the white of egg. But the coagulating action of the forty-per-cent. solution is very much less decided than pure carbolic acid. Electrozone has no coagulating effect whatever. A five-per-cent. formalin solution added to meat broth,—that had been infected by a broach used in a putrescent pulp-canal,—and allowed to become putrid, showed in a test-tube much more vigor of chemical action and rapidity of clearing of the infection than did a similar test of electrozone added to the same putrescent liquid. I have found formalin to be very efficacious in disinfecting, without causing irritation, those cases of quiescent pulpless teeth whose pulp-cavities demand opening, but are very liable to have pericementitis supervene as a result of such opening.

When I was a young man, I was very much distressed by the evidence that was often presented to me that I had precipitated pain and suffering upon my confiding patients by opening their pulpless teeth. But I found, to my astonishment, that those whom I considered wise men could give me no special light or encourage-

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ment on the subject. Indeed, most of them denied that the opening of such teeth was the cause of any special solicitude to them. They applied some medicament which in their hands always prevented trouble, and each one had a different remedy; but in my hands afterwards none of these agents proved of sure value in preventing inflammation, as the result of opening pulp-canals with putrid contents, that had been closed and were not causing irritation at the time.

Dr. James Truman wrote in the "American System of Dentistry," 1885, "A dead pulp may remain for years—and it may be for life—very quiet if not exposed by caries, but may, in a few hours, produce violent pericementitis if exposed to the action of the atmosphere. It is, therefore, oftentimes a question in the diagnosis of such a tooth whether the great risk warrants meddling with it at all."

I think there is now a general recognition of the danger attending this procedure, but I fear it is not by any means universal among dentists, and I call attention to it to emphasize the importance of its being recognized, as well as to record the usefulness of formalin as an efficient preventive.

I had not found anything to serve the purpose as well as iodoform dissolved in alcohol and ether until the advent of electrozone. In 1884 I read a short paper on antiseptics, in which I referred to iodoform as the most effective safeguard against inflammation, as a result of opening quiescent pulpless teeth, and until I began to use electrozone as a disinfectant I had not dared to rely upon anything else in such cases. I have used the latter, however, with satisfaction ever since its introduction, and it undoubtedly has a certain soothing and reducing influence on inflamed tissues, besides its antiseptic power.

In exactly what cases, and in what conditions, solutions of formaldehyde will serve better than electrozone or other agents it will take some time to determine. Each remedial agent that we have has its limitations, and each has a sphere of influence that makes it better adapted to certain conditions than anything else would be, but there is no doubt that formaldehyde is a valuable addition to our list of medicaments, and it is probably destined to take the place of most of the prophylactics we have used heretofore. It simplifies and renders easy the sterilization of instruments and of everything that needs disinfection, and there can be no doubt that a one-half-per-cent solution is perfectly efficient for such purposes after the article has been previously cleansed in an ordinary way.

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Such a solution does no harm to steel instruments, other than results from the application of water, and Drs. De Buck and Vanderlinden, of Ghent, have found it more efficient than a two-and-a half-per-cent. carbolic or a 1 to 500 sublimate solution.

I have noticed that an antiseptic lotion advertised for a mouth-wash has in the published list of ingredients a 1 to 1000 solution of formaldehyde in a proportion not given. I find that a one-half-per-cent. solution of formaldehyde, if rinsed vigorously about the mouth, produces a stinging sensation, suggesting the effects of capsicum, and even a one-fourth-per-cent. solution does not cease to have a similar effect on the mouth and fauces, although the sensation of astringent action is also perceptible with the latter. As far as antiseptic power is concerned, we may certainly count upon its value here also, but what medicinal effect it will have on the mucous membranes and gum tissues will have to be determined by experimental use.

It is apparent that this substance has a medicinal influence aside from its antiseptic effects, and that a great portion of its value to us depends upon its peculiar medicinal action. The irritable condition of a pulpless tooth that will not bear stopping up is not amenable to control by antiseptic treatment alone, unless the agent used has also a medicinal influence on the tissues. And the same thing is true regarding the contents of pulp-canals in pulpless teeth that threaten to produce irritation by access of air or germs. The application of the most potent antiseptic is not so certain to avert unfavorable symptoms as is the use of iodoform, which is rather low down in the antiseptic scale, but which has a certain power aside from germicidal action that produces a beneficial effect on living tissue. In other words, the usefulness of medicaments, suitable for the treatment of abnormal conditions of living tissue, cannot be expressed in terms of antiseptic power. The latter has engrossed attention to such a degree during recent years as almost to exclude the fact altogether that almost every agent used has a medicinal or toxic action, which may be beneficial or the reverse.

The preserving and hardening effects on tissues that have been manifested by formaldehyde suggest that it may be found of service in efforts to preserve and make innocuous those dead pulps, or portions of pulps, that circumstances make it desirable or expedient to leave *in situ*. Any simple and quick means of accomplishing this would result in such great saving, to both patient and dentist, that all must regard it as a desideratum.

Probably we would all agree in the opinion that no treatment of

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a pulpless tooth can ever fulfil the requirements of placing it in the safest condition for the longest time, as does the complete filling of the root-canals with an impermeable substance; but there is a possibility of approximation to the ideal condition of safety by some other less arduous and expensive method. Several experimenters and writers have discussed this subject in recent years, and I hope this new agent—formaldehyde—may serve to forward to success efforts in this direction. The teeth of the multitude, who cannot afford either time or money for difficult and expensive operations, need to be saved by simple and inexpensive methods, and I am sure we all sympathize with every effort to render the process of saving teeth easy and simple.

In commending formaldehyde to your attention and study, it is with the conviction that it is to be a very valuable addition to our equipment of therapeutic agents. The limitations of its usefulness will soon be discovered, but at present its value is undoubted in the treatment of foul pulp-canals, and irritable apical tissues, and in the disinfection of anything that needs such cleansing.

The Chairman.—The secretary will now read a communication which has been received from Dr. Louis Jack, of Philadelphia, upon this subject, after which discussion will be in order.

Dr. Jack.—In the use of formalin I have not had much experience. Since the range of employment does not appear to be wide, and as it is a powerful agent, one should be cautious in its application.

Its chief value depends upon its rapid diffusibility, and for this reason it is serviceable for the disinfection of the dentine in canals which have been long subjected to the presence of putrescent material. For this condition I have used five-per-cent. solutions with apparent advantage. This would be indicated by my experience to be as strong a solution as it is safe to employ. At this strength it is necessary to protect the adjacent tissues by sealing the saturated pledget in the pulp-chamber and canal, allowing it to remain for a few hours. It is important not to force the solution through the apical foramen: concerning this accident I had a serious experience when, notwithstanding the existence of a fistula, great pain and continued irritation was excited which slowly yielded to treatment. The effect upon the fistulous tract in this case was not curative since the suppuration was not arrested, as would probably have followed the application to the same *situ* of zinc chloride ten grains to one ounce of water.

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In exposures of the pulp, preparatory to conservative treatment, I have frequently used and have found a solution of five per cent. of formalin serviceable where there had long been caries with rather broad exposure. For recent exposures, when the bacterial invasion of the dentine were less, I used two and one-half per cent.

As the value of formaldehyde depends upon its quick diffusibility, therefore its use would appear to be confined to conditions which require penetration of structures. Its irritating properties, on the other hand, limit its use as a topical agent for superficial disturbances, as they occur in the mouth. I am not prepared to give an opinion of percentages lower than the smallest rate I have above stated.

Dr. Allan.—A little over a year ago I began to use formalin, having heard of it through Dr. Jack, as Dr. Howe did; and my experience with it has been such that I do not well see how I could get along without it. In the class of cases Dr. Howe describes there is a great deal of irritation and pain, not accompanied by a formation or discharge of pus, but simply due to some peculiar condition, and a permanent stopping is not possible, as intense pain follows closing the root-canal. In these cases I have found that an application of a three-per-cent. or five-per-cent. solution of formalin will almost always work a thorough cure, one application often being sufficient. I treated a lower bicuspid for my brother for nearly a year, possibly longer, and as he lives at Newburgh, I could see him only occasionally. Sometimes I thought I had made a success of it, but he would write me in a day or two that the filling had to be removed. The last time he was down, about two months ago, I treated the tooth with a five-per-cent. solution of formalin, following it with hydrogen dioxide. In a week or so he wrote me that he had some pain after the treatment, but not sufficient to induce him to have the filling taken out. After a little the pain entirely subsided, and the tooth is now ready to fill permanently. While in formalin we have almost an ideal preparation for the class of cases which Dr. Howe has alluded to, we have not yet secured all we need. Formalin will unite with the albuminoids and organic tissues to form a fairly permanent compound; not wholly permanent, for with the access of germs sooner or later putrefaction will take place. There is no doubt of that.

Formalin is employed in the laboratory for hardening tissues preparatory to section-cutting, and is a most valuable agent; but if a mass of tissue so hardened is taken from the solution and exposed

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to the air of the room, germicidal action soon commences and decomposition and destruction of the tissue follows.

Formalin has an irritant action, irritating the skin or mucous membrane to which it is applied; it has an escharotic action, and kills tissue in strong solutions, but it is not toxic in character, nor is it poisonous when administered even in strong doses; therefore, in weak solutions, it is exceedingly valuable as a mouth wash, and in all preparations to be used on the teeth. I have used formalin a great deal in ordinary cavities where I wish to bring about an aseptic condition preparatory to filling. Formalin is exceedingly penetrating; being an aqueous solution, it is more penetrating than any of the essential oils. I have used it in ordinary cavities, as strong as a ten-per-cent. solution, and what pain followed passed away rapidly and no harm resulted. I am very favorably impressed with its use in such cases. I have not used it long enough to say anything more, except that it is probably the best all-around antiseptic and germicide that we have had brought to our attention. I use it constantly to dip instruments in when cleansing the teeth, removing tartar, etc., about one-half of one-per-cent. solution, not stronger than that, and I have never had a patient complain of pain, irritation, or troublesome action on its part. I am very glad that Dr. Howe has thought best to bring this agent before us, and I heartily indorse all he has said in its favor.

Dr. S. E. Davenport.—I should like first to compliment Dr. Howe upon his complete report of this comparatively new remedy. I think it proves that Dr. Allan, the chairman of the Executive Committee, who I think suggested the formation of these committees in our Institute, made no mistake, and that our president, Dr. Lord, knew what he was about when he appointed the chairman of the Committee on Materia Medica and Therapeutics. Through Dr. Howe's courtesy I have been in possession of a vial of formaldehyde, five-per-cent. solution, for six months, and while I am not one who takes readily to new remedies, and use probably fewer medicines in my office than most operators, I have in quite a number of cases which refused to yield to the remedies I have been more accustomed to use, given formalin quite a thorough test. One case I remember in particular,—I will not enter into details, except to say of it that twice within three weeks did I leave my dinner-table to remove the temporary stopping from this inferior third molar, it having been treated with other remedies,—with electrozone once, by the way,—but when formalin was used as a dressing I was able to eat my dinner in peace, and the tooth is now filled and comfort-

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able. I think it might be well, if Dr. Howe is willing, not only for our information, but for the readers of our proceedings, for him to say a few words regarding the reduction of formaldehyde from its forty-per-cent. solution to the different strengths which have been mentioned in his report.

Dr. Howe.—I think the easiest way that it can be presented is to regard the forty-per-cent. solution as forty parts of the drug formaldehyde, divided by a unit of water, instead of a hundred parts of water, which it really is. If we take an ounce, or a teaspoonful, or any amount, and consider it as stated, and desiring a one-per-cent. solution, we add thirty-nine teaspoonfuls of water,—supposing that we use a teaspoon to make our dilution,—and we have divided the forty parts of formaldehyde by forty parts of water instead of one, which we took as our starting-point. If we want a five-per-cent. solution, we add seven teaspoonfuls of water to one teaspoonful of the forty-per-cent. solution: we have divided the forty parts of the pure article by eight instead of one, and have obtained a five-per-cent. solution.

Dr. Bogue.—Will Dr. Howe tell us whether this solution is a permanent one, or subject to deterioration?

Dr. Howe.—I think it is very little subject to deterioration. One writer only, whose remarks on that point I have observed, claims that it requires to be fresh. On the other hand, there are many who claim that it is remarkably stable. Almost all the alcohols are, I think, liable to full oxidation, which converts them into acids, as is shown in the facility with which wine and cider are converted into vinegar, if there is access of air. But the oxidation of methyl alcohol seems to be capable of permanent restraint at the aldehyde condition. It is claimed that forty-per-cent. solutions, kept in stoppered bottles, showed only a maximum increase of one-tenth per cent. of formic acid in eleven months. I have some that has been in my office over eleven months that seems to be perfectly good.

Dr. Allan.—Fearing that I may be misunderstood I will say that the formalin of commerce, which is a forty-per-cent. solution of formaldehyde, has been my basal preparation, and the different solutions to which I have referred have been made by reducing formalin by the addition of water.

Dr. Davenport.—Then Dr. Allan's ten-per-cent. solution is Dr. Howe's four-per-cent. solution.

Dr. Howe.—If the manufacturers of the solution tell the truth, they have made a forty-per-cent. solution of formaldehyde in water.

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I had not thought of accepting this as the unit of value, because it is a solution of known strength, and is presented in this form for convenience only. I think the name formalin is used by most persons only as a contraction of the real name, and not as adopting the production of one manufacturer as the original article with which we are dealing. I should not consider it desirable to adopt the proprietary name of an article in which no one has any proprietary rights, especially as by so doing we would be liable to lose sight of the chemical nature of the article. And I think it would lead to confusion to regard a solution as if it were the original substance, and refer to percentage solutions of a solution, instead of referring back to the compound itself.

Dr. C. F. Ives.—It is a little less than a year since Dr. Howe gave me a sample of formalin, and I think that it is one of the best remedies I have had. I want to speak of a case which came to me a few weeks ago. It was an inferior first molar. A dentist out of the city had treated it for three or four months. It was so irritable that every attempt to close it resulted in pain, which made necessary the removal of the stopping within from one to three hours, and, becoming discouraged, the dentist concluded to let it alone. The tooth finally became so troublesome that the lady could not pack in cotton sufficiently tight to exclude food without having to remove it in the course of an hour. That is the condition it was in when she came to me. I applied the dam and dried out the cavity thoroughly, finding nothing in the roots to indicate any particular trouble. After a little necessary cleansing, I applied a five-per-cent. solution of formalin, carrying it to the extremity of the roots, and sealed with gutta-percha. I did not see the patient again for ten days, and when she came my first question was about the tooth. She said, "I have forgotten all about it, I have had no trouble from it since." I immediately filled both roots, and put a permanent filling in the cavity. That was two months ago, and I have heard nothing from it since. The day before yesterday a lower bicuspid having a very long and tortuous canal presented itself. In this case the pulp had been destroyed in Syracuse, and the lady was directed to attend to it when she reached here. She neglected it for four or five months, and when I saw her the face was very much swollen and she was suffering severely. I introduced a fine broach and passed it to the end of the canal, and, finding no opening, went through with a drill made from a fine banjo string, and applied a two-and-a-half-per-cent. solution of formalin. The result was that the pain ceased. Then I made one more application,

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and it is ready to fill permanently. It seems that just in those cases which resist everything else, formalin has a remarkable effect. I have made it a practice to swab out all cavities before filling with a five-per-cent. solution, and it has a marvellous action.

Dr. Z. T. Sailer.—I take it for granted that the medicine acts beyond the root, because, if the root is cleansed thoroughly and filled to the apex, trouble follows just the same as if a lesion exists in the membrane outside. It is a very great irritant, and I cannot see how it becomes curative, although it is possible, according to the evidence to-night. Dr. Allan cites the case of his brother, who, being a dentist, should be able to give us positive information in regard to this important question.

Dr. Howe.—I suppose that the trouble in the class of cases referred to, for which this remedy seems to be especially adapted, is a condition of irritability beyond the apex of the root; not *in* the tooth. The fact that formalin is a great irritant, and at the same time capable, in dilution, of allaying irritation, is a peculiarity of the remedy that pertains to other drugs also, but generally in less degree. Medicinal action is something that no one, I think, can explain. I do not know that there is any explanation of the way each drug has its peculiar medicinal or toxic effect. Each one has an individuality in its effects, and the fact that it does so is something that we are glad to act upon, when we have the knowledge; accepting the fact and doing the best we can with it.

Dr. Allan.—The drug formaldehyde in strong solutions is a direct irritant, destroying the life of the part to which it is applied. In weaker solutions, not strong enough to exert a necrotic action, but having decided germicidal properties, it quiets pain by destroying the germs of putrefaction and inflammation. The pain from using a ten-per-cent. solution of formalin even on a sensitive tooth is very transient. In repeated applications I have never known the pain to last over five or ten minutes. This is, as I understand it, an explanation of the apparently contradictory properties of the drug.

Dr. Howe.—It is to be noted that germicidal properties alone do not fulfil our requirements, because no other germicide is capable of accomplishing what formalin does in certain conditions. Peroxide of hydrogen, bichloride of mercury, and electrozone are very effective in that sphere of action, but neither of them will reduce the peculiar irritable condition we have considered in the tissues just beyond the apex of a pulpless root. Formaldehyde does it very promptly. Its effect is different entirely from ger-

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micidal action, or is an effect in addition to that of germicidal action.

Dr. A. J. Weed.—I do not believe there is much irritative effect. I have used formalin to attack an abscess, washing out with a little salt-water and packing with antiseptic cotton dipped in formalin. My object was to see if there was periosteal inflammation. The patient did not complain of any decided pain.

Dr. Howe.—It did not produce pain?

Dr. Weed.—She did not complain of any more pain than from packing with cotton. I used a five per-cent. solution, simply wetting the end of the cotton.

Dr. Howe.—It is in just such cases that formalin is so useful.

Dr. Kimball.—I am glad your attention has been called to the medical aspect of this question, because I think we have sometimes overlooked that in our treatment of the peculiar class of cases that has been described. In newly-opened pulpless teeth I have used for many years a first dressing of tincture of aconite, bearing in mind its therapeutic action on the adjacent tissues. The result has been good, producing almost no irritating effect, and allaying any tendency to inflammation which may have arisen from admitting air to the long-closed cavity. Its effect has been very satisfactory, but I am glad to have this additional anchor to use in these troublesome cases.

Dr. Bogue.—I want to ask for some help, but before asking for it I should like to make a little acknowledgment to Dr. Howe for his kindness in giving me a sample of formaldehyde some months ago. Unfortunately I left it behind me last summer, and could not find it until two or three weeks since. I have had occasion to use it once or twice, each time with marked success. I found myself very ignorant in the use of it, and wanted to know more about it, and my presence this evening has been fortunate for me. The help that I want is right in the line of this committee's report, and it is also in the line of operative dentistry. We have heard a good deal of late about cataphoresis; we have been deluged with advertisements from men, professional and otherwise, in regard to an instrument called a volt-selector, and many of us have invested our pennies in it, and some of us, perhaps, have run in debt for it. I suppose we must have some new plaything every little while, or we are not happy. I should like to have the members of this society tell me what is the use of the so-called "volt-selector." It is said to produce certain effects in two directions where we need assistance very much, and possibly in a third. Those two directions are

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in the anæsthetization of sensitive cavities which we have to excavate, and the driving electrically of a bleaching agent into the dentine for the purpose of bleaching discolored teeth. Those who have had more experience with cataphoric processes than I have will probably be able to send to the committee, of which your humble servant is chairman, and which wants to make a report, some positive information upon these points. I received a telegram a few moments since from Dr. Palmer, who requests me to say in regard to this matter that he had several patients—perhaps five or six—for whom he had used cataphoresis with cocaine to obtund the sensibility of cavities which he was excavating, and in almost every instance—I say almost so as to be on the safe side—the patient complained of subsequent pain. And in one case where I used it myself the patient said, "Well, I do not want that thing any more; as a rule, when I go away from here with a tooth filled that is the last of it, but I have been nearly thirty-six hours now suffering from that tooth which was filled, and I do not like that." If that experience has been had by others I should be very pleased to know of it. I think we ought to give a fair, just, and impartial examination into the question. I think that is what we are doing in this society; and if any members can give the result of their knowledge in that direction I shall be obliged.

Dr. Davenport.—I might call Dr. Bogue's attention to a short article in the March number of the INTERNATIONAL DENTAL JOURNAL, from the pen of Dr. Rollins, of Boston, on this subject; and judging from the little Dr. Rollins wrote, I think it might be worth Dr. Bogue's while to ask Dr. Rollins to say more upon the same subject.

Dr. Bogue.—Very much obliged. I will do so.

Adjourned.

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A REGULAR meeting of the Institute was held Tuesday evening, April 7, 1896, at the residence of Dr. J. Morgan Howe, 58 West Forty-seventh Street. The President, Dr. Benjamin Lord, in the chair.

The minutes of the last regular meeting were read and approved.

The President.—It was thought by the Executive Committee that it would not be wise to call upon the regular committees for reports this evening. We hope they will not be discouraged, because it must be felt by all that it is through these committees that this Institute is to accomplish its best work. We hope the time is not far distant when the committees will be called upon at regular intervals, and their reports thoroughly discussed and criticised.

COMMUNICATIONS ON THEORY AND PRACTICE.

Dr. W. St. George Elliott.—About two months ago one of the surgeons of St. Mary's Hospital came to see me professionally, and incidentally spoke of a boy under his care who had ankylosis of the lower jaw. He asked me to see the case, which I did; I was there during the operation, and it was most interesting. There was complete ankylosis on both sides. The boy was about ten years of age, a Southerner, but there was no history to be obtained of the case. There was imperfect development of the lower jaw, the symphysis being at least an inch back of its normal position. The operation consisted in forming a flap and going into and breaking up the adhesions of the joint, and with mallet and chisel cutting away the end of the ramus and entirely relieving it from its bony attachment. The result of the operation was rather favorable. I took an impression of the upper and lower jaws as far as possible. The mouth was fixed in a semi-open position, probably not quite half an inch, and through that small aperture I introduced a piece of board, on which was some impression compound, and succeeded in getting an impression of the upper and lower jaws. The lower jaw was so short that the lower incisors presented themselves almost horizonally. The general health of the patient was good and he made a very rapid recovery. The one object I had in seeing the case was for the purpose of making a spring splint to give the jaw a certain amount of motion so that it would not become reattached. This was found unnecessary, as the boy voluntarily moved his jaw a good deal. The jaw was forced open an inch or an inch and a quarter. From that time up to the pres-

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ent he has continued to have fair power of mastication. The temporal muscle has been largely lost, but the other muscles continue in good form.

The President.—If there are no further communications on theory and practice, we will listen to the paper of the evening, and I have the great pleasure of introducing Professor A. A. Breneman, late Professor of Industrial Chemistry in Cornell University, who will address us on some of the physical properties of the metals, and as all dentists are supposed to be metallurgists—more or less—we may consider it a great favor to have our attention called to the subject by one who has given it special study.

SOME OF THE PHYSICAL PROPERTIES OF METALS.

BY PROFESSOR A. A. BRENEMAN.[1]

It has been well said that science is only "educated common sense," and there is nothing in science that is valuable in practice which cannot be told in language quite plain to intelligent persons outside of the given field of science. The subject for this evening, "Some Physical Properties of the Metals," is one of very wide range, so I shall limit my talk to a consideration of some of the physical properties of the more familiar metals, especially such as you in your work are accustomed to deal with. The term metal itself is difficult to define. A well-known authority on this subject has said that there is no representative metal,—that is, that no one metal combines in itself all the qualities which occur to us when we use the term metal; the only typical metal is an ideal metal.

Before going into a consideration of the properties of metals on which I expect especially to dwell, I will first ask your attention to a matter of theory. Theory in chemistry and physics is something like diagnosis to the physician, it outlines the subject and furnishes a bases of treatment. Unlike diagnosis in its limited meaning, a given theory may furnish a working hypothesis for the entire science. The method of scientific progress within the age in which science as such can be said to have had a real existence, has been that of fixing upon some interpretation of facts already at hand, and upon the basis of this interpretation of facts constituting a theory by which to devise experiments that will act as a test of the theory, and serve also as a means of discovering new

[1] Late Professor of Industrial Chemistry in Cornell University.

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facts. Every theory starts upon a very small basis, a mere guess may be the beginning of it, but science is not content with guesses. The guess must be tested by experiment. The guess serves only to suggest an experiment, and the result of the experiment is itself a test of the value of the guess. Add together many guesses or speculations, and many experiments testing the validity of these speculations, and we have the basis of a theory. It has been said that in science one "guesses and checks his guesses." In this matter of devising experiments which shall serve as a test of speculation, imagination itself is an important factor. The mind must move through all the materials it has at hand and pick from them a suggestion for its second step. Many years ago Professor Tyndall used the expression, "the scientific use of the imagination," and wrote under that title an essay which will always be regarded as a classic; yet in his day Professor Tyndall was taken to task by shallow people outside of science for the use of the term, and it was claimed to be an admission that, after all, the matter of science was largely imagination. No greater mistake could have been made. The meaning of Tyndall was that the imagination must be used for its suggestiveness in devising experiments. After that, experiment will settle the value of the suggestion. You see, then, that the imagination in this sense, while it is given an important place, is entirely subordinate to the principal work of science.

Now, in considering any form of matter we must know something about all conditions in which matter can occur. Matter, as you know, can take any of the three states,—solid, liquid, or gaseous; and we shall find that our familiar substances, the metals, can occur in all of these conditions. In fact, any metal can be made to take the state of a solid, a liquid, or a gas by changes of temperature merely. There is a well-known liquid metal, mercury, and there is good reason for believing that the lightest of all gases, hydrogen, is itself a metallic body. That most metals, however, are solids is familiar enough to you. It has always been my experience that in speaking of the properties of matter, and in thinking of them, one works with more system and with more effect if he has at hand an intelligible theory of matter. What is the difference in these three different states of matter; and why should a solid, a liquid, and a gas have each their distinctive properties? Chemists and physicists have long ago come to the conclusion that, in the main, a theory of matter which regards it as made up of distinct and very minute particles serves best to explain the properties of matter. There are exceptions to this, of course;

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there are other theories which have had a certain support in all ages, but the working theories of physical science deal mainly with the atom and the molecule as the units of matter. By an atom we mean an exceedingly small particle of matter. Primarily the term means something which cannot be further divided, but the discussion of the definition in this sense is merely a metaphysical one and need not concern us here. Let us assume that somewhere, in subdividing matter, we come to a practical unit,—the smallest particle. It is further believed that these atoms of which simple elements are composed can unite and form groups of greater or less size, and these groups, whether made of the same kind or different kinds of matter, we call molecules. There is good reason for believing, although it cannot as yet be proved, that there is, after all, but one form of matter, and that the seventy odd elements which the chemist knows of as distinct forms of matter may themselves be merely groupings, of more or less complexity, of one primary matter.

To deal now with these units of matter, the atom and the molecule, let us consider first the state of gas. A gas is believed to consist of particles of matter separated by distances much greater than their own diameters, which particles have a free motion that carries them forward in straight lines until they are arrested by contact with other atoms or with other forms of matter. In a liquid body the particles differ principally in that they have less freedom of motion. A particle of gas, we believe, might fly indefinitely in a straight line if not arrested. A particle of liquid seems to have somewhat the motion of a pendulum; if not a direct to-and-fro motion, at least a motion in which the particle returns, after a path of greater or less complexity, to the point at which it started. A liquid, therefore, while it has no definite shape, has yet a power of holding together, as may be seen when it forms drops. Mercury when spilled upon a plane surface breaks into little globules, and below a certain size the particles of mercury show a strong tendency to hold together. This tendency to hold together is only an expression of the fact that all the particles of this mass are confined to a certain sphere of motion and cannot move away from one another indefinitely, as the particles of a gas do. In the solid state it is believed that the difference is merely one of less freedom of motion permitted to the particles. The molecules of a solid have probably the same pendulum-like motion, but in much shorter paths than those of a liquid, and the distances between different molecules are evidently much less. If you will keep in your minds these rough

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distinctions between the three conditions of matter as they affect the molecules or smallest particles of a mass, you will have a mental picture which will enable you not only to recall the properties of matter more readily, but to explain the behavior of matter under given conditions when you have occasion to think of it.

Let us consider the properties of the metals themselves. One of the most evident properties of the metals, one in which they differ widely in degree, is that of hardness. Consider the range of hardness exhibited between the liquid metal mercury, or the metals sodium and potassium, which can be worked like putty between the fingers, and the hard metal iridium, or its alloys, which are used for giving points to gold pens. Or consider, again, the hardness of steel, a form of iron differing only from iron in having a certain proportion of carbon in combination. Why should one metal be hard and another soft? It is not a question merely of weight, because the softest of all metals, mercury, is one of the heaviest. I think you will see that the hardness of a metal depends in some way upon the difficulty of pushing the molecules apart. The point or edge with which you try to scratch the metal cannot enter it because the molecules of the metal persist each in following out its little path and refuse to be pushed out by the foreign substance used to test its hardness. It is the motion of the atoms which resists the point that tries to penetrate the mass.

Closely related to the property of hardness is that of tenacity. By tenacity we mean the power of resisting rupture. The tensile strength of a metal is measured by shaping it into a wire or rod of known cross-section, and then noting the force exerted at the moment when that rod or wire is broken apart by pulling upon it. Tenacity depends again upon the power of the molecules in persisting in their original paths. Anything which separates one portion of the mass of metal from another must, to some extent, interfere with the motion of the molecules as it existed previous to rupture.

Malleability is a property which is closely related to tenacity. We mean by the term malleability simply the property of flattening out under the hammer. Gold is an eminently malleable metal, it can be beaten into thin leaves. A metal which is spread out into a thin sheet under the hammer evidently suffers a violent displacement of many of its molecules; many of them are forced to take up new positions entirely different from those which they first occupied; and while their motion may not be greatly affected in the new position, a great deal of friction has occurred during the change,

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and this friction is made evident by the amount of heat set free during the change of position of the particles.

Brittleness is the reverse of malleability. While the majority of metals tend rather to malleability than to brittleness, yet there are marked cases of this second property. Antimony and bismuth fly to pieces under the hammer. Even zinc, at certain temperatures, is as brittle as glass and can be ground into a powder. Ductility is a property closely related to malleability. It is the quality which permits a metal to be drawn out into wire. This property depends again upon the persistence of the molecules in their chosen paths, their power of holding to those paths and to one another. Whether this is a quality of actual attraction of particle to particle, as iron is attracted by a magnet, or whether it may not be some interlacing of the paths of oscillation of each particle, which links the mass together in a certain way, it is impossible to say.

Of the property just mentioned there are applications in the arts which rest upon such explanations as have been given. The drawing of wire, the spinning of metals upon a lathe, the spinning of a sheet of metal into the form of a hollow vessel through its tendency to escape from the point at which it is pressed between a hard surface and a hard tool, and the so-called squirting of metals under pressure, are all related to the foregoing properties. The squirting of a metal is effected by confining a soft and malleable metal in a cylinder, where it receives the pressure of a piston, while at the same time it has no means of escape from this pressure except through a small orifice in the bottom of the cylinder. Under these conditions the metal escapes through the small opening in the shape of a wire, or ribbon, or tube, according to the shape of the opening, and behaves as it passes through the opening as if it were in a liquid state. It is evident that the particles escaping through the orifice have moved very widely from their original position in the mass. It is evident, also, that as the piston descends in time so as to expel all or nearly all of the metal, that all of the particles originally in the mass must have suffered great changes in position. We speak in such cases of the metal flowing; and, doubtless, as in the flow of a stream of water, the motion is greater about the centre of the mass, and less along the sides. But at any given moment the motion at the orifice is evidently much greater than at any other point of the mass. Here there has been imparted to each particle, besides its own proper motion, which may have persisted all the time, a very large motion of displacement; it has been carried along as it moved somewhat as the moon moves in its

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own path around the earth and yet moves with the earth through space. The amount of pressure required, the degree of friction, and, therefore, the quantity of heat set free,—all of these depend originally upon the nature of the metal itself. The special form of motion which its particles originally had, the distance of those particles from one another, and probably also the weight of those particles, are all elements of their behavior. Yet by this analysis you can form a certain picture of the moving particles as the piston descends and the mass in the form of wire escapes from the opening.

The mobility of metals is a property nearly connected with those just treated of. I have said that a gas is perfectly mobile. In liquids we have very different degrees of mobility. The light liquid, ether, moves readily in a containing vessel, much more so than water. Mercury, although a much heavier liquid, is extremely mobile. A basin of mercury from which light is reflected so that the reflected light can be measured by the motion of a bright spot over a graduated scale is the most delicate instrument for recording motions too small for the unaided eye to see, and a surface of mercury is a most ready means of registering very slight earthquake tremors.

The flow of metals under such stress as is given in hammering or wire-drawing, or squirting, depends largely upon their mobility. Furthermore, when metals are thus changed in shape under the action of forces they seem to undergo a change which leaves them permanently altered under ordinary conditions; although this change can be annulled by very simple means. It is as if the particles at first violently crowded out of their places had not been left room for that free motion which they originally had, but are under a condition of constraint. Suppose that at certain points of the mass they are crowded together so that the original length of their path is not permitted. This would evidently produce some difference in quality, because the structure of the mass is not what it was at first. In practice we know that the mere device of heating a metal so strained or warped, for a considerable time, to a temperature below its melting-point will bring it back to its original condition, so that it will show again the same malleability, ductility, etc., as before; whereas, under the temporary strain it may have been harder or more brittle than at first. In the beating out of metallic foils, or in the drawing of wire, it is necessary to stop from time to time and anneal the metal,—that is, heat it to a certain temperature and allow it slowly to cool. Under these conditions there seems to

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be given that opportunity for the particles to return from their cramped positions to the original freedom of motion, and the metal regains its former properties. In the harder metals, such as iron and steel, the term *fatigue* is used to express the condition of strain under which the metal exists after the action of force upon it; and the fact that under the normal conditions it will in time regain its original properties quite justifies the use of the term fatigue.

In their behavior under heat metals exhibit the greatest variety of action. Mercury is a metal liquid at common temperatures; it is melted at those temperatures. We have only to cool it to 40° below zero and it becomes a solid body. And so we have among the class of metals every variety of fusibility, from mercury at the lower limit to such metals as chromium and platinum at the higher. One melts below the heat of the hand, others only at a temperature of the oxyhydrogen blow-pipe. Inasmuch as all matter expands under the action of heat,—that is, extends its boundaries in all directions,—we are led to believe, upon our present theory of matter, that the effect of heat upon its particles is simply to make them move with more force, and therefore through wider limits. It would be expected, therefore, that when a solid body such as a metal is sufficiently heated, its particles would push themselves apart until the distance between them was so great, and their own freedom of motion so great, that the solid state would be lost and a liquid would result. And if the temperature were carried still further, a further increase of motion would result finally in absolving all the particles from their attraction for one another, and from their motion, perhaps, in fixed paths, and would give us in time the perfect freedom of motion which exists in a gas. Solid, liquid, and gas, therefore, are simply three states of matter differing in the heat or pressure which has been applied to them; and there is no substance which cannot be brought, at a sufficiently low temperature, into the state of a liquid or a solid, or at the other extreme of temperature, into the state of a gas. And we may go further and say that there appears to be certain analogy between this uniform change of state which occurs under the action of heat and the peculiar and partial changes which occur when malleable or ductile metals are submitted to pressure or tension. Possibly the effect of force at the point where it is applied is such as to throw the particles immediately about that point into violent motion, or to give them that great freedom of motion which corresponds to the liquid condition. It has been very shrewdly said that malleability is "indeterminate fluidity." Remembering that the

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three states of matter are all of them continuous with reference to one another, that there is no sharp dividing lines between the solid, the liquid, and the gaseous states, it may be said that great pressure, or great force exerted in tension, simply brings the matter immediately under pressure into a changing state which is the bridge or link between two different states of matter.

Another property of matter of less importance to us here is elasticity, the power quite common to many metals, but possessed in widely different degree by different metals, of returning after elongation or compression to their original shape and form. A bar of steel may be drawn to greater than its original length, or it may be compressed to less than its original length, and yet when the force is removed it will return accurately to the first dimensions. If stretched or compressed beyond certain limits, it fails to return; it is said to have passed beyond the limit of elasticity. Here again we recognize a condition of freedom of motion within certain limits, and beyond that a condition of constraint; and applying it as before to the motion of the particles, we say that in the one case the particles have been moved out of their position but not so far as to prevent them returning to their original paths; the path may have been elongated, may have been contorted, but the original motion could reassert itself. In the second case, under strain the particles were compelled to take permanently new positions and to acquire to a certain extent new paths.

Color and lustre are surface qualities. Color depends merely upon the fact that the particles at the surface of a substance vibrate in unison with the medium from which they receive the light; light itself being a form of motion. But, inasmuch as white light is made up of many different rates of vibration, corresponding to the different colors which compose it, the vibrating particle receives or absorbs only the motion which corresponds to its own rate. The color represented in that motion will be lost from white light. The color corresponding to a different rate of motion, and therefore not absorbed, will be thrown back or reflected from the metallic surface, and the surface will appear to us to have a corresponding color. Copper is red because it absorbs from sunlight or white light all rays but the red and throws the red rays only back to the eye. Most metals absorb little of the motion of light, and throw most of it back. They are usually, therefore, of whitish or grayish color. Lustre is merely reflection of the light as a whole. A metal with an unpolished surface breaks up the light and reflects it in many different directions. In a polished surface all particles are

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lying virtually in the same plane, and all rays of light are thrown from that plane at the same angle. There is a difference to be noted, however, between the true lustre and simple reflection. Lustre is a quality of reflection, and is easier to name than to describe. Illustration will perhaps make my meaning clearer. We have only to think of the difference between the reflection of a plain glass mirror, on the one hand, and the lustre of polished lead or iron on the other. A slight element of color is introduced, perhaps, into the reflection, and this is the characteristic element in lustre.

The subject of alloys cannot be omitted from a discussion of the properties of metals. By an alloy we mean a mixture, in its simplest sense, of two metals; but the term mixture can by no means be used without qualification. It is, indeed, begging the question to use such a term, because the nature of alloys is one of the profoundest subjects of discussion in chemistry and physics. Are alloys mere mixtures, such as may be made of ink and water, or are they chemical compounds, such as occur when sulphur and iron are heated together? Some metals, when melted together and then cooled, show properties differing so greatly from those of either of the original metals that we can hardly believe them to be merely mixtures of the two. The alloy instead of melting at a temperature which is a mean of the melting-points of the two metals proportionate to their weight, generally melts at a lower point than this mean. Its powers of conducting heat and electricity, its relative volume, its solubility in acids, a large number of its properties, chemical and physical, are different from those of either of the original metals, and different from the mean quality of these metals with reference to the proportions taken in the alloy. Also it happens in many cases that, with certain definite proportions of two or more metals, we have alloys of new and remarkable properties; while a slight variation in the proportions, instead of giving merely proportionate change in quality, gives an alloy very little resembling the first. Now, this definiteness of properties corresponding to definiteness of composition is the characteristic and the test of chemical combination. The subject, however, is too wide a one to follow here. There are arguments, though fewer, in favor of the belief that the alloys are merely mixtures, but a compromise view is, perhaps, the most reasonable. We cannot escape the conclusion that chemical combination occurs in many cases, but the difficulties on the whole are simpified by assuming that alloys which are definite compounds may themselves dissolve in an

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excess of one or the other metal in the alloy, as many chemical compounds dissolve in the separate ingredients of the compound. And such an explanation would probably meet most cases where true chemical compounds are not formed.

There is one other point concerned here. There is a phenomenon known as allotropism, which very much modifies the qualities of elements and compounds. By allotropism we understand, referring again to our molecular hypothesis, an arrangement of the atoms within the molecule, such that the same substance, as iron or silver, may, without changing its chemical nature at all, exhibit very great difference in physical properties. Allotropism may even make changes in chemical properties, but the distinction is that the change is always a temporary one, and that the allotropic form of matter can always be brought back, and generally by simple means, to the original state of the same matter. For example, common phosphorus is a yellowish, wax-like solid, which melts at the temperature of the hand, and dangerous accidents have resulted from its handling. Red phosphorus is a substance obtained by merely heating common phosphorus with exclusion of oxygen. This second form of phosphorus is a red powder, requiring a temperature much above that of boiling water before it will burn in the air, being entirely safe to handle, not acted upon by chemicals in the same way, and practically harmless, while common phosphorus is a deadly poison. And yet we have merely to heat red phosphorus to a certain temperature in the air and it passes back at once to the state of common phosphorus. Oxygen, the familiar gas of the air, is readily converted into another gas, called ozone, which differs in a most marked degree from oxygen, and yet at a certain temperature it passes back into oxygen. We have in these cases, then, a simple change of physical quality without the slightest change of chemical integrity. The substance could be converted in a closed vessel from one state to the other and back again, nothing being added and nothing being taken from it.

Just as we have these cases of non-metallic allotropic bodies which I have given for the purpose of illustration, so we have among the metals some remarkable cases of allotropism. Tin under the action of great cold takes the condition of a grayish brittle substance, in which the original metal would not be recognized; yet there is no difficulty in bringing this back to the original tin. Silver, antimony, copper, and other metals also form allotropes.

Not to dwell further upon this subject, there is reason for be-

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lieving that in alloys many metals may exist in the form of their allotropes, and so even if these alloys were mere mixtures, we should expect them to have qualities different from those of the metals concerned, or from the mean qualities of the metals. Whatever latitude we give to chemical or physical interpretation of the phenomena presented by alloys, it is certain that in the main changes of quality go with changes of proportion. Considering the number of the metals, the readiness with which the qualities of the alloys change with the proportions of these metals, and the infinity of permutations thus possible, the task of outlining the properties of all possible alloys is an infinite one. You will see, from the very brief treatment made of some of the properties of metals that the study of the alloys themselves offers a field for life-long investigation. However, what one knows practically of the metals may be applied at once in the study of their alloys, and I may hope, at least, that the few facts which I have passed in review before you, and the attempt that I have made to connect them and marshal them, so to speak, under a comprehensive theory, may not be without some element of practical value to you.

DISCUSSION.

The President.—I am sure all will agree that Professor Breneman has given us much general information on the properties of metals, and the subject is now before the meeting for discussion, inquiry, and criticism.

Dr. Elliott.—I would like to ask Professor Breneman whether it is possible to make an alloy that is perfectly homogeneous, one in which the relative component parts are the same and remain the same in all parts of the ingot.

Professor Breneman.—That is an interesting question, and it touches the phenomenon of *liquation* or the separation of the elements of the alloy during cooling. The matter of preserving perfect uniformity in the mass of some alloys, however carefully and thoroughly they have been made, so that they shall remain exactly the same after cooling, is a difficult one. There is a tendency in the more fusible elements in a liquid mass to separate themselves as the less fusible portions become hard, and so to gather in the centre of the mass, the part last to cool, and there to form a mixture or compound of different composition from the portions first to cool. This has been the bugbear of metal-workers in many different lines. The prevention of it depends in special cases upon special devices; no general method can be given. If the cooling mass

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within its mould could be continuously shaken during its cooling we should probably have the best approach to uniformity in the mass, but this is generally impracticable. Frequently a slight change in chemical composition will reduce the tendency to separation. Some processes of working metals are based not upon preventing, but upon encouraging this tendency. The tendency of the ingredients to separate during the hardening of a liquid mass is common to all forms of matter. A familiar case is that of water in freezing. It has long been known that the impurities in a freezing mass of water are pushed together so as to concentrate in the portion last frozen. This was a serious difficulty in the early operation of artificial ice-plants. If the water was not thoroughly purified the ice at the centre of the block, or the portion last frozen, would contain impurities sufficient to injure the entire mass of ice. The remedy for this, in the case of artificial ice-making, is, of course, to have the water as pure as possible. The water should be distilled, and distilled under conditions which will regulate its purity. To return again to what happens in a cooling mass like this, I should say that as the molecules build themselves up into a solid state, often into a crystalline state, the more fusible portions, which will also be the more mobile under those conditions, may be crowded out, as it were, and escape through orifices left in the hardening mass.

Dr. E. A. Bogue.—Is there any way by which metals so widely different in the melting-point as silver, tin, and zinc may be alloyed and made homogeneous?

Professor Breneman.—The question is somewhat complicated by bringing in three metals. There is no inherent difficulty brought in merely by wide differences of melting-point. Metals that differ most widely in their fusing points may very readily alloy. The difficulty when it occurs is one depending rather upon an unknown physical peculiarity of the metal, and if it cannot be conquered by the use of another metal which serves as a mediator between the two it is difficult to conquer. Certain metals in very minute proportions will effect a kindly union of metals otherwise apparently incompatible. In certain cases this may be merely a reducing action, where the mediating metal serves to reduce portions that exist as oxides and keep the metals apart, keeping their surfaces from uniting. This, I think, is the most general explanation of this mediating action, but it is an entirely general explanation. The day may come when tables may be made in which, with the proportions of the elements varying uniformly on a scale of equal

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parts, we may find without experiment the properties to be expected from mixing given proportions of metals.

Dr. S. E. Davenport.—I should like to ask Professor Breneman whether there is a scientific foundation for what I seem to have observed within the past few weeks, or whether I have allowed my imagination to run riot. During my professional life I have been using the so-called redistilled mercury supplied in the various dental depots for amalgamated alloys. Recently it has seemed to me a matter of sufficient importance to make an effort to get the mercury purified to a greater degree, and I have succeeded in interesting a chemist in the question. He has supplied me with mercury as pure, he says, as it is possible to make it, using some peculiar processes which, no doubt, Professor Breneman knows all about. As I have been using the same alloy, for most of my amalgam fillings for more than ten years, it seems to me that I ought to be able to recognize even slight changes. With this purified mercury the color of the filling is improved, less mercury is needed to incorporate the filling, and the mixed mass seems more homogeneous and finely granular.

Professor Breneman.—Perfectly clean mercury is very difficult to obtain; primarily because of metallic impurities which, while they are mainly separated by distillation, are not so easy to separate absolutely; and minute traces of foreign metals may greatly affect the qualities of the mercury. Perfectly clean mercury is necessary in many physical experiments. When we confine a mass of mercury and measure its volume in a graduated scale we want the mercury to make a sharp meniscus, as it is called,—that is, to curve upward. If it contains impurities, or if the tube is dirty, the mercury instead of making a clean upward curve will be almost flat in its surface within the tube. To purify mercury we resort, first of all, to distillation and redistillation; but sometimes we find that a small quantity of impurity will persist even after distillation. There is a peculiar power existing in certain liquids of carrying over as they boil the vapors of other liquids which in themselves have a much higher boiling-point; a great deal of one vapor will carry over a little of the other, and that little may be a harmful quantity. There is also greasy matter, probably some hydrocarbon-oil which has a boiling-point near that of mercury, therefore very difficult to separate by distillation; and such impurities may very much impair the value of mercury in use. Where distillation does not answer, chemical purification may be resorted to. The action of dilute nitric acid, while it will dissolve a very little

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of the mercury, will dissolve all of the contaminating metals. Other oxidating solutions, like sulphuric acid and bichromate mixture, will serve. Sometimes there are minute mechanical impurities which can be gotten rid of by filtration through cotton under pressure, or through a thin layer of porous wood under high pressure. Generally chemists find one or the other of these means to answer the purpose, but sometimes many means have to be adopted, and occasionally it is extremely difficult to get thoroughly clean mercury.

The President.—Will Professor Breneman tell us whether he thinks aluminum will come into use in the arts or in manufactures to any considerable extent?

Professor Breneman.—I think that until we have a cheaper method of manufacturing aluminum it cannot possibly displace the use of iron to any great extent, although there are many cases in which its lightness and its beauty, and its freedom from attack, are elements worth paying for. The production of electricity—and aluminum is manufactured by a process of electrolysis—is at best an expensive process. Even when power in such quantities as is supplied at Niagara Falls is to be had it is not procured for nothing. The great tunnel, the immense power-houses, the tremendous dynamos set up at Niagara for the making of aluminum and other things cost a great deal of money and the wear and tear is great. Besides that, the ores from which aluminum is made at present are not very abundant nor very cheap. While common clay contains aluminum in great quantities, there is at present no practical method of separating it from the clay. However cheap the raw material may become, it is unlikely that any process of working it by electricity, a process which uses carbon poles, themselves rapidly destroyed, which uses an agent requiring expensive machinery, and which makes its products by the single ton instead of by hundreds of tons, will ever be a dangerous competitor with iron manufacture. Aluminum to-day costs, by the cheapest process, about fifty cents a pound. It will be seen that the interval which separates it as a competitor from iron at a cent and a quarter a pound or less is very great.

A vote of thanks to Professor Breneman for his very interesting and instructive address was given.

Adjourned.

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A MEETING of the Institute was held on Tuesday evening, May 5, at the residence of Dr. Benjamin Lord, 34 West Twenty-eighth Street, the president, Dr. Lord, in the chair. The minutes of the last meeting were read and approved.

The president introduced Dr. Dawbarn, who brought with him for exhibition before the Institute two patients. One was a young girl with a non-malignant type of epulis springing from the socket of the upper right first molar. It had been first noticed nearly two years before, and had not grown much since then. It was at this time not larger than a pea. Of late it had seemed to be the starting-point of attacks of facial neuralgia upon that side.

The other patient was a young woman who developed the sarcomatous type of epulis—as proved by microscopical examination—springing from the sockets of both bicuspids upon her upper right side, and being of nearly a year's duration when Dr. Dawbarn first saw her. He operated by removing all the teeth on that side save the central incisor, and then chiselling away the entire alveolar process for a corresponding distance. Healing was prompt and complete, but after two months there was some recurrence at two points. For this reason Dr. Dawbarn entirely excised both of her external carotid arteries, making two operations for the two sides, as it is a long dissection. The object was to starve out the growth by shutting off its main blood-supply. This succeeded, as both places of recurrence gradually disappeared, leaving sound healing again. Whether there may ultimately be again a return only time can show. She will be watched closely, and in that case the entire right upper jaw must be excised. Because the resulting deformity from this would ruin any chance of marriage, Dr. Dawbarn thought the attempt to save the jaw justifiable.

The president thanked Dr. Dawbarn for so kindly exhibiting the patients, and commended him for his skilful treatment of them, and then called upon Dr. W. St. George Elliott, the chairman of the Committee upon Recent Dental Literature for the report of the committee, which was read by Dr. Elliott.

REPORT ON RECENT DENTAL LITERATURE.

Your committee beg to report that they have given the matter of a report on recent dental literature a good deal of thought, and while believing that such report might be made of importance, yet there are many difficulties in the way. Your committee, like most

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committees, cannot get together often, and were they to do so, could not work harmoniously, the difficulty being that no two members can have the same views as to the importance or non-importance of certain articles. In this first report we beg to offer some suggestions. First, that only those be appointed on this committee who are willing to bestow the necessary time and labor; second, that we report but once a year.

We think there is no subject now before the profession so important and so interesting as that of cataphoresis, and there are several articles in the journals worthy of study. We know that cataphoresis is but the forcing into the system of various medicines, through the agency of the electric current, for various purposes; that a pressure of a maximum of, say, twenty volts is necessary with a current of less than an ampère; that an essential feature is that the pressure must be turned on, increased, and decreased gradually, or pain will result. With these essentials before us, we can more clearly look into the various statements made. Our friend Dr. Morton contributes to the January *Dental Cosmos* a paper on the subject, and brings forward the combination of guaiacol with cocaine, the former containing eight per cent. of the latter; the combination of these two sedatives are supposed to act much more promptly than when given alone. This idea does not seem to be sustained by any experiments or proofs. Drs. Morton and Gillett both bring forward the Wheeler volt-selector, an apparatus for turning on the current slowly; it is misnamed a volt-selector, and is merely a suitable reostat. There are several ways of obtaining the current. First, the street current, of one hundred and fifteen volts, passed through a suitable resistance, as the Wheeler volt-selector, to the patient; second, the use of a primary battery with resistance; and, third, the combination, or, more properly, the street current passed through a storage battery. By the means just alluded to—the street current passed through resistance, and thus to the patient—we meet with the serious objection that the street voltage varies as high as ten per cent. in pressure, and one per cent. sudden increase or decrease of pressure produces pain. In the second process, a primary battery is used, with resistance. This plan has much to commend it, for the apparatus is portable and efficient, the only objection being the cost. A good dry-cell battery, with milliampère meter and switch, costs some fifty dollars, and, with full use, will not last over a year, when all the cells must be replaced. In the third process, the storage cells (ten), of two volts each, and costing five dollars and fifty cents each, are kept saturated by con-

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nection with the street current, while switches, milliampère meter, and perhaps voltmeter, with resistance, form the necessary apparatus.

Drs. Morton and Gillett use the first form of current,—street, Wheeler volt-selector, etc.,—while Drs. J. Morgan Howe, Van Woert, and others the primary battery. Dr. Brown, of Montreal, uses the street current through storage cells, and Dr. Rollins uses thirty-volt candle lamps as resistance, together with a rotary resistance, probably the familiar German-silver wire resistance-box, taking his current from the street. There is sufficient evidence now before the profession to prove that there is something of value to us as dentists in cataphoresis, but it is not an unmixed blessing, and does not prove of value in every case. The present objection to the apparatus is the time required, averaging, say, fifteen minutes. But experimental efforts should reduce this. One minute is long enough; indeed, we see no reason why it may not be made so rapid that we can carry the cocaine into the dentine by the use of our excavators while in the act of excavating. The objection at present to this, in addition to the time, is the pain from making and breaking circuit when the instrument is applied and removed. This might be obviated by using a large current with low voltage; say, ten ampères and one volt.

In the January *Dental Cosmos* there is an interesting article by Dr. W. E. Walker, of Mississippi, calling attention to an unnoticed anatomical fact,—*i.e.*, the downward slope of the roof of the glenoid fossa. It is for this reason, the doctor states, that a set of artificial teeth articulate perfectly in the articulator, but failed to do so when placed in the mouth. Natural lateral motion in the lower jaw must be accompanied by a downward one as well. Dr. Walker states that this angle varies in different individuals from twenty-two to forty-five degrees, and in his own articulator the angle is made adjustable.

Dr. Black, of Illinois, has an excellent article on the influence of oxidation in alloys to produce contraction. His experiments prove his statement, but the older members of our profession remember when we were all told to work away the oxide with alcohol, and how, years afterwards, we were told not to work them. Here we have a text upon which we might expatiate all night. There has been a tendency in the profession, unfortunately, to follow any one who makes a statement, without regard to proofs. Thanks to Dr. Miller, Dr. Black, and others, we are now more incredulous, and want at least some evidence to support assertions.

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In the *Journal of the British Dental Association*, Rutherford, of London, advertises a new crown, all porcelain, the only novelty being that the hole in the crown is oval, and a flattened pin, cemented in, is used.

Dr. Strang, of Bridgeport, Conn., recommends the combination of oxyphosphate and amalgam. First alloy is mixed with mercury. Then phosphate powder added, and finally liquid phosphoric acid.

In an editorial in the *Items* there is a good deal said of injury to the teeth by the tooth-brush, and this statement is made: "It is a shame to see the destruction of so many sets of nice teeth from this cause." Perhaps Dr. Welch's opportunities for investigation may have been remarkably good; at all events, the chairman of this committee, in his twenty-six years of dental practice, has yet to see the first set of teeth ruined in this way, while an innumerable number have been vastly injured by the lack of thorough cleansing. Your committee beg to state their belief that it is not possible to produce a true case of erosion by the tooth-brush. With the great majority of these cases there is a sharp edge, and it is impossible for this edge to be produced with the brush; on the contrary, brushing the teeth would soon destroy the sharp edge. Patients should always be instructed to brush from the gums, as being more efficacious than across the teeth.

Dr. Sudduth, of Minneapolis, has a good article in the February *Dental Cosmos* on pyorrhœa, mechanical removal of irritants, pyrozone thirty per cent. and cocaine in pockets, and in extreme cases zinc chloride, with other medicaments.

Dr. Driscoll, of Manatee, Fla., describes his mode of using oxyphosphate and amalgam. First introduce the mixed phosphate into the cavity, and, before setting, press into the cement a button of alloy. There are some objections to this plan, unless great care is used to prevent the cement getting to the edges.

Dr. A. H. Brockway spoke favorably of the report as read by Dr. Elliott, and said it had always been a favorite idea of his that the interests of a dental society could be furthered by occasional reference to and discussion of papers already published in the journals. For that reason he expected good to result to the society from the work being done by Dr. Elliott's committee.

The Committee on Operative Dentistry, Dr. E. A. Bogue, chairman, stated that the report of that committee would not be read for lack of time, but would be presented at a later meeting still further amplified. An extract from Dr. McNaughton's portion of the report was read, because it gave the formula for his obtundent. This

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obtundent is composed of equal parts cocaine and thymol made by heating the thymol in a test-tube until it is melted and dissolving the cocaine in it. For sensitive dentine a piece of asbestos paper is saturated with this and placed in the cavity over as broad a surface as possible, and this is covered with zinc phosphate for several days.

The remainder of the report was stated to consist of experiments with the new volt-selector, so extensively advertised at the present moment as serving to obtund the sensibility of teeth by cataphoresis.

The committee found that from fifteen to forty minutes were required to secure immunity from pain with this particular instrument, and that the process was very disagreeable and not free from dangers of various kinds, not the least of which was the danger of so thoroughly displeasing the patient as to permanently offend him. The results of a few experiments on bleaching teeth are promised for a later date.

The President.—There is now an opportunity for any who wish to speak upon this subject of cataphoresis. We would be glad to hear from Dr. Allan, of Newburgh.

Dr. C. F. Allan.—I would like to say that the experience of Dr. Bogue in the use of cataphoresis has not been mine in the one extreme case in which I have tried it. Some weeks ago, Dr. Van Woert was kind enough to bring his apparatus to Newburgh, and I had a patient on hand, a young lad of thirteen or fourteen years, and for whom I had found it difficult to work, who was suffering from a deep crown cavity in an upper second molar, and in whose mouth our ordinary remedies for obtunding pain were quite useless. The boy wanted to do his part, tried hard always to bear the necessary pain, and simply found it impossible. He was evidently anxious and fearful of this new method, and the use of electricity had to him the meaning of something strange and fearful.

One had to be very gradual in the turning on of the current, and it was thought best to keep it on an unusually long time, three-quarters of an hour, but at the end of that time there was no more pain than if I had been working on a block of wood, and the boy was delighted. I could use the bur with the utmost freedom, and the turning up of the leathery decay and the completion of the filling was without any apparent resuscitation of feeling.

I have seen the patient several times since, and there have been no unpleasant after-effects, such as spoken of by Dr. Bogue. A twenty-five-per-cent. solution of cocaine was used.

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I would say that with the lack of fear, the result of his practical experience of this method of treatment, this same patient would require probably not half the time in a future case to accomplish the same result.

Dr. G. S. Allan.—The Executive Committee has received a communication from Dr. Jack, of Philadelphia, upon this subject, which, with the president's permission, I will ask the secretary to read.

Dr. Louis Jack.—As Dr. Allan will inform you, I have been using acceptably the apparatus No. 11 of the Chloride of Silver Dry-Cell Battery Company, of Baltimore. This was chosen because it has been efficient for medical purposes, and further, that it had attached to it the Willms controller, which gives the most gradual gradation of the resistance. This commences with a resistance of ninety thousand ohms, which is reduced by one hundred and twelve contacts, and therefore these furnish a very slow gradation.

The well-known fact that the chloride of silver cell is extremely constant, and that it has a ratio of voltage to ampèrage which is acceptable to the human tissues, were further reasons to lead me to adopt this source of current.

The voltage of each cell is one and the ampèrage between one-fifth and one-fourth of one ampère.

I have used eighteen- and twenty-four-per-cent. solution of cocaine hydrochloride and of the citrate, the latter appearing the most efficient. The citrate at present is procurable of Merck & Co., of New York.

A most important consideration concerning the application, as it appears to me, is that the force of the current be not great. I have found ten to twenty volts efficient, and that this degree of force has been sufficient generally to produce the effect desired. For children I use ten or fifteen cells; for adults, fifteen or twenty cells. It is evident that if the voltage be high the necessary consequence must be the evolution of heat in the tooth, which may have some influence upon the after condition of the tooth. Thus far no secondary symptoms have appeared in my practice.

It may be interesting to give the history of four clinical cases, each of which was extremely sensitive to the lightest touch.

Case I.—Buccal aspect of lower bicuspid cavity broad but not deep; applied cocaine hydrochloride sixteen per cent., with the addition of two drops of carbolic acid. Selected twenty cells; controller-switch carried to 180°, or fifty-second pin. Time, fifteen

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minutes; relief nearly complete, some pain being indicated at the extreme lateral margins when grooving.

Case II.—Small cavity in proximate surface of central, which had been cleansed, but the sensibility forbid completion. First applied cocaine hydrochloride eighteen per cent. for twelve minutes, which did not completely remove sensibility; then applied the citrate, same percentage, for a less period, with absolute relief There was no record of the voltage.

Case III.—Lower bicuspid; occlusal surface denuded of enamel, apparently dense; cocaine citrate sixteen per cent., twenty cells, selected; time, twelve minutes. Considerable cutting was made to form cavity when some acuteness appeared; reapplied same solution with twenty-five cells for same period, when the excavation was completed without pain.

Case IV.—Lower molar buccal surface at cervix, including part of mesial aspect; cocaine hydrochloride twenty-four per cent.; time, twelve minutes of twenty cells, and continued eleven minutes more with twenty-five cells. Complete excavation and retention made without pain.

The two latter cases were typically severe ones, which required nearly twice the usual time. Dr. Allan, having been present, will be able to describe the results.

The President.—I now have the pleasure of introducing one of our members, Dr. Samuel A. Hopkins, of Boston, who will read a short paper on cocaine.

COCAINE.

BY SAMUEL A. HOPKINS, M.D., BOSTON, MASS.

Ever since the discovery of anæsthesia the idea of a local anæsthetic has taken firm hold of the professional mind, and no amount of failure has been able to shake our belief that some day or other the ideal local anæsthetic will be forthcoming. It must be safe, it must be easy to administer, and it must be quick in its effect.

We need a safe local anæsthetic. There is perhaps no greater need in modern surgery and dentistry. The mental anguish, as well as the actual suffering entailed by our daily operations is appalling. It makes the profession of dentistry the most trying and exhausting one known. The pain which we are obliged to give is not only injurious to the health of the patients, but it limits our usefulness, and even affects the estimation in which our profession is held by the community at large. So much, therefore, is to be

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gained by the use of a local anæsthetic that the temptation is very great to try everything that may promise an alleviation of pain, and we are loath to give up anything that seems even in a moderate degree to give that alleviation, although its use may be attended by grave risks. Indeed, we sometimes deceive ourselves so great is the desire to save pain, and are almost persuaded that any risk is justifiable to gain such an end.

This, I am afraid, has been the history of the use of cocaine in the dental profession. It is a sufficient comment on its doubtful efficacy in dentistry that after so many years of experimentation it should still be necessary to publish articles in our dental journals describing its use and its limitations, and the fact that you are willing to listen to me to-night indicates that grave doubts still exist in your minds as to its unrestricted use in dentistry being justifiable.

In order to get at the facts concerning the use of this drug I have gone over very carefully a very large amount of literature on the subject, and have looked up some of the records of the cases where serious results are reported. I am indebted for valuable information to Dr. T. W. Hays, who, in March, 1894, before the Cincinnati Academy of Medicine, read a most interesting paper on the physiological action of cocaine, citing numerous authorities.

The symptoms of cocaine-poisoning differ materially in different individuals, and there is probably a disposition or diathesis existing in some individuals which renders them exceedingly susceptible to the drug. Great difference exists in regard to the time it takes for poisoning effects to appear. This may vary from thirty seconds to three hours, and the time necessary for recovery also varies greatly. Sometimes recovery is almost immediate, and, on the other hand, it may take months, and then leave the patient in a very anæmic condition. The sex, age, or condition of the patient does not seem to have any particular influence on the effect. Strong or weak, young or old, all may be quickly affected. Neither are habitual users of the drug, those who have formed the cocaine habit, entirely free from the dangers of acute poisoning.

The size of the dose and the method of its administration do not seem to control the effect. There is, however, seemingly a peculiar susceptibility when the drug is applied or injected in the vicinity of the fifth nerve or its branches. Woffler, who favors the use of cocaine, states that in most of the cases that have come under his observation where serious or fatal results have followed its use the injections were made in some part of the head. He claims that a

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five-per-cent. solution may be used with impunity in other parts of the body, but a solution of not greater strength than two per cent. can safely be used in the region of the head.

In a general way, the symptoms of cocaine-poisoning may be briefly described as follows: There is an excitation of the mind, and associated with it an expression of anxiety which may amount to a fear of approaching death. A feeling of warmth steals over the patient, which may be followed by a chill. The respiration becomes fearfully rapid, and later becomes labored. The pulse-beat increases to a very marked degree, and the pulse runs up to 150, or even higher. Respiration becomes more difficult, and the heart grows weak, while the mental disturbance is increased so that ideas do not follow each other in proper sequence. If the drug has been administered in the mouth, the tongue becomes numb and speech is affected; not always, however, to such a marked degree as might be expected. If the poisonous effects continue, there seems to be more general anæsthesia, and the organs so affected have a decided feeling of cold. Sometimes an irritation along the spine or back of the neck, a tickling or itching sensation, is present. The hands are closed in a convulsive manner; the fingers, legs, and arms become stiff and tetanic. The muscles of the face partake of the convulsive movements, and the expression is agonizing to the last degree. In some cases death occurs while in this tetanic condition. Sometimes, however, instead of the convulsive symptoms complete relaxation takes place. If recovery occurs, severe nervous disturbances may remain for an indefinite time.

The symptoms I have described as belonging to cocaine-poisoning are subject to wide variation. Indeed, no two cases seem to give exactly the same train of symptoms. In going over the records I have been astonished to find how many cases of poisoning are reported. Mannheim reports five cases of poisoning from the subcutaneous use of the drug, and also nine cases in which it was dropped into the eye; two where it was used in the ear; larynx, three; mouth, two; gum, two, etc. Four drops of a two-per-cent. solution used by injection produced poisoning in an old lady, who did not recover for four days. Three drops of a three-per-cent. solution was followed in one case by marked restlessness, which disappeared in four days. 0.05 grain in one case and 0.04 grain in another injected subcutaneously into the eyelid caused intoxication lasting many hours. Dr. Hays, among other cases, mentions the fact that he himself was poisoned by cocaine injected

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into the gum. It is but fair to state that the dose was large, but the poisoning was almost instantaneous.

The March number of the *Centralblatt* mentions a fatal case of poisoning following an injection into the urethra. In the October, November, and December, 1890, numbers of *Therapeutische Monatsschrift* is given a complete list of the reported cases of poisoning up to that date. The percentage of fatal cases is enormous. Of one hundred and seventy-six cases recorded, ten were fatal. Enough has been said of the general poisoning effects to show that the drug is one to be used with great caution. We do not yet know what its dangers may prove, nor have we yet found a physiological antidote. Digitalis, atropine, the nitrite of amyl, and nitro-glycerin have been suggested, but the efficacy of these drugs is still a matter of doubt.

I found it a much more difficult matter to get any definite reports of serious results following the use of cocaine in dental practice. This was, of course, to be expected, as most of these cases occur in private practice, and cannot be reported without injury to the reputation of the practitioner. Consequently, we get only meagre accounts of the unsuccessful cases, or of those cases which are attended by fatal or alarming symptoms. Each successful case is, however, quickly reported, much to the glorification of the operator, and the temptation to follow in his footsteps leads to many an accident.

Appreciating this difficulty, I wrote to a number of leading New York dentists, asking for their experience in the use of the drug. I also asked, "What should be considered the maximum dose for hypodermic injection into the tissues of the mouth?" This last question has never been answered, nor can I answer it myself.

The greatest courtesy was shown me, however, and I received a large number of replies to my letter, but I will not attempt to read them, as I have promised to be brief. A large number of those who so kindly answered my letter frankly said they were unwilling to risk hypodermic injections in any strength. A few alluded to the alkaloid, isoatropyl-cocaine, and its dangers, and all expressed the feeling that great caution should be used in administering the drug hypodermically. Dr. Delafield, under whom I had the pleasure of studying at the College of Physicians and Surgeons, wrote that he thought it should never be used hypodermically. My own experience seems to bear out this opinion, so far as it relates to injections into the tissues of the mouth.

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I have myself had the scare, and although several years have now passed, it sends a cold chill down my back whenever I recall my experience. One case I shall never forget of a man in apparently perfect physical condition, for whom I had to perform an operation upon the gum between the lower first and second molars, which necessitated giving great pain. My syringe was carefully sterilized, and ten minims of a four-per-cent. solution were taken into the syringe; two minims remained after the operation, and at least two minims were absorbed by the napkins with which I surrounded the parts, so that it is safe to say that the results following were produced with a dose of not over six minims. The gum was relaxed and somewhat torn, and undoubtedly a part of the dose got into the mouth and may have been swallowed. Be that as it may, in about ten minutes there was a seeming excitation of the mind, and all the symptoms which I have previously described soon followed. I was obliged to get my patient onto a bed, and send for his physician. By the aid of stimulants—brandy and coffee—the patient gradually recovered, and was able to be driven to his home in three or four hours.

In another case, that of a young woman, the patient left the office in apparently good condition after an operation in which the drug had been used, but complained that while in the car on her way home she experienced difficulty in breathing, with palpitation of the heart, and had to exert all the power of her will to get to her house. She did not recover fully for several days. In this case not over four minims of a four-per-cent. solution were used.

A similar case to the above was that of a vigorous young man, who was a student. He likewise did not feel the effects until on his way to Cambridge; but as he had access to several convenient bar-rooms on his way out, he was able to get sufficient strength to reach his rooms. In this case not over three minims of a four-per-cent. solution were injected, and none escaped into the mouth. While the after-effects of this case were not serious, a terror of similar results was produced that made him willing to submit to the most painful operations rather than have me make use of the drug again.

I have found hundreds of cases of cocaine-poisoning reported in various medical journals, both in this country and abroad, and shall be glad to give these references to any one who wishes to investigate this subject further.

Suggestions of new methods for doing away with the danger

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have appeared from time to time during the past fifteen years, and in the December number of the *Dental Digest* an article from the pen of a careful observer suggests the combination of cocaine with morphine and atropine.

Whether we have any safe or reliable substitute for cocaine in the various combinations that are suggested from time to time has not yet been determined. There is, however, a substance which deserves more than passing notice on account of the high character and scientific standing of the men who have made the investigations concerning it. Dr. A. P. Chadbourne, of Boston, in 1892, before the British Medical Association, read a valuable paper on an alkaloid which had recently been isolated by Giesel from the leaves of a small-leaved cocoa-plant of Java. The chemical constitution and properties of this substance were studied by Liebermann, who proved that it was benzoyl-pseudo-tropein. Chadbourne gave it the name of tropa cocaine, and under that name it is now sold by the leading manufacturers of drugs.

In his paper, a careful study of which I would recommend to any one who contemplates using this drug, Dr. Chadbourne relates a series of carefully-performed experiments with tropa cocaine, using cocaine of equal strength upon the control animals. I cannot, of course, give these experiments in detail, but the conclusions drawn, which were amply supported by the evidence, were as follows:

1. Tropa cocaine is less than one-half as toxic as cocaine.

2. The depressing action both on the cardiac motor ganglion and the heart muscle, especially the latter, is much greater with cocaine.

3. Local anæsthesia, both of the eye and of the skin, is much more complete with tropa cocaine, and is possibly of longer duration.

4. Solutions of tropa cocaine are moderately antiseptic, and retain their strength for at least two or three months, while cocaine solutions begin to deteriorate in as many days.

Experimentation on the human subject confirmed the above conclusions and seemed to demonstrate that tropa cocaine was twice as strong and half as toxic as cocaine. There is, however, one possible source of error in using tropa cocaine,—viz., the possibility of obtaining an impure sample of the drug. Dr. Chadbourne, in his experiments, procured one sample that was much more toxic than the others; not more toxic than cocaine, however. But after purification by recrystallization the difference disappeared.

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It is also rather expensive, and the supply of small-leaved coca-plants is naturally limited. One other difference might be considered an objection. Cocaine has a contractile action on the small blood-vessels, which tends to arrest hemorrhage; tropa cocaine has no such action.

After writing the above, I took the liberty of calling upon Dr. Chadbourne, and asked him if he had seen any reason to modify his views on the subject of the two drugs. He assured me that the experience of those who had made use of tropa cocaine only tended to confirm the conclusions he had drawn from his experiments. In the course of our conversation he gave me an important point in the treatment of cocaine-poisoning, which I have not seen referred to elsewhere. He found that with the animals experimented upon a much larger dose of cocaine could be used if the temperature of the room were lowered, and the animal recovered from the toxic effects more quickly when the body temperature was lowered by exposure to cold. This suggests that an ice-pack or exposure to the cold air in winter might give considerable relief in these unfortunate cases of cocaine-poisoning. He also confirmed the statement I have already made that an injection in any part of the head is more liable to be attended by toxic symptoms than in other parts of the body.

I do not wish to be understood as advocating the hypodermic injection of this new drug into the gum for the extraction of teeth, or other operations. I merely wish to affirm that if a local anæsthetic is to be used in this way that there is some scientific basis for experimentation with tropa cocaine, and it will probably be found much more effective and a thousand times safer than any of the nostrums that are offered to the public as substitutes for cocaine.

One other method of local anæsthesia I must refer to, as it is now before the public, supported by men of recognized skill and intelligence,—namely, the use of the electric current in connection with cocaine and guaiacol, or cocaine alone. For a more detailed account I would refer you to Dr. W. J. Morton's article in the January number of the *Dental Cosmos*, to Dr. Gillett's article in the February number of the INTERNATIONAL DENTAL JOURNAL, and to other more recent articles, which will repay careful study.

I have seen cocaine used by cataphoresis a sufficient number of times to convince me that it has a place in dental practice, and I mean to use this method for obtunding sensitive dentine in extreme cases. It is, however, too cumbersome to be used as a routine

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method. There is usually more or less pain, sometimes a good deal of nervous apprehension attending its use, and in some cases it fails to make any appreciable difference in the sensitiveness of the tooth. This may be due to faulty manipulation. The dam should always be in place when this method is applied, as I am not convinced that cocaine used in this way is less poisonous than when used in the ordinary manner. Two possible improvements have suggested themselves to me,—one would be to have the obtunding done by an assistant, and thus save fifteen minutes of your valuable time, for the loss of time is a serious objection to this process; and the other would be the substitution of tropa cocaine.

The suggestion has recently been made that the incisors may be rendered insensible to the touch of the instrument by placing pellets of cotton saturated with a ten-per-cent. solution of cocaine in the nostrils. I have seen this tried with entire satisfaction, but I hesitate to endorse the method from the danger of forming the cocaine habit. Doubtless, you know that snuffing cocaine up the nose is a particularly delightful form of indulging in the cocaine habit and one that is easily acquired. Singers sometimes acquire the habit by using the drug to dry up the secretions and get temporary relief while singing. Neither the morphine nor the alcohol habit compares with the cocaine habit in the undermining influence on the mind and body. For this reason I should discourage the use of cocaine by this method.

Another method of producing local anæsthesia with cocaine was suggested by Dr. Schleich, of Berlin, who recently published a monograph on the subject. Briefly, it consists of an almost infinite number of injections of an almost infinitesimal amount of the drug. The injections are made, not subcutaneously, but intracutaneously, and the technique is somewhat as follows: Beginning always in the healthy skin, and holding the syringe almost parallel with the skin, the needle is introduced, great care being taken not to push it through the skin. The fluid will distend the skin and raise a white, bloodless wheal. This area is instantly anæsthetic. Keeping within this area, you introduce the needle near its edge and produce another œdematous white spot. In this way you can gradually anæsthetize a foot of territory. The anæsthesia lasts about twenty minutes, and infiltration can be repeated if necessary. In dealing with inflamed tissue it is always desirable to encroach upon it gradually from the surrounding healthy tissue. In operations requiring deep incisions the gradual process should be adopted in getting at the seat of the disease.

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The strongest solution used contained only two-tenths of one per cent. of cocaine, and the weak solution contained only one-hundredth of one per cent. of cocaine, with a little salt solution added. Indeed, it is pretty evident that the anæsthesia comes more from pressure on the terminal nerve filaments than from the drug itself, since it can be shown that a two-tenths-per-cent. salt solution injected in the same way will produce anæsthesia; not, however, without severe irritation. Chemists are prepared to furnish tablets made according to the formula of Schleich, and this is, perhaps, the best form in which to obtain the drug for this method of administration. How general this method will become no one can predict, but I know of the successful removal of a good-sized abdominal tumor, several operations for varicocele, the opening of a felon, and a lot of minor operations. The mouth hardly offers the best field for the practice of this method, but in a general way it is not without interest.

I cannot close this paper without a reference to the wholesale extraction of teeth by ignorant or unprincipled practitioners, who advertise the painless extraction of teeth by the use of so-called obtundents. For several years past we have been receiving from time to time in our mails advertisements of obtundents which are to be used by injection. In almost every instance the advertiser claims that no cocaine is used, and tempting offers of exclusive territory and dazzling riches to follow the use of this particular preparation are held out to the unwary. By reference to an article in the May (1893) number of the *Dental Cosmos* it will be seen that nearly all of these preparations contain a large percentage of cocaine. This article is by Dr. Edward C. Kirk, of Philadelphia, who had a number of these so-called local anæsthetics chemically examined in the Philadelphia College of Pharmacy. There were ten different preparations, all of which had been widely advertised, and in almost every case the impression had been given, if it had not been positively stated, that the preparation contained no cocaine. It was found on analysis that every one of the preparations, with the exception of Barr's, which was merely an alcoholic solution of peppermint and cloves, contained cocaine, and many of them in such large amounts as to be dangerous even in small doses.

Unfortunately, the use of these preparations seems to be increasing. Of course, no self-respecting man could be guilty of violating the code of ethics of his profession by manufacturing and advertising such nostrums. It is well understood that the profession has a right to any discovery or improvement that may be made

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by one of its members, and each man in the profession is under distinct obligation to give to the profession any knowledge that he may have acquired that will benefit his fellow-practitioners.

It seems to me that it is equally a violation of the code to use and recommend any nostrums that may be put upon the market. In this particular case there is an additional reason for taking a high stand, as a disguised danger is more to be dreaded than an open one. It would be well if we could bring about such legislation as would make it a criminal offence to deceive the public by flooding the market with such nostrums, but I am not sanguine about our power to institute reforms by legislative action. We have to combat not only the inertia of political bodies, but the opposition of uneducated and unprincipled practitioners as well. Every peripatetic tooth-puller eagerly avails himself of these preparations, reckless of the danger, and while it would be a great gain to humanity to exterminate this species of dental practitioner, I can see only one way to accomplish it, and that is by a crusade of education and the creation of a higher and better public opinion.

It is the duty of every man in the profession to use his influence in warning the public against these fearful traps laid for the unwary. Every means in our power should be used to expose the charlatans who, for a fee, are willing to subject a patient to any risk, and who are doing irreparable injury by the wholesale extraction of valuable teeth. We must check this evil if we wish to uphold the dignity of our profession and preserve our self-respect. How we can handle this problem best it is difficult to know; but with high ideals and a high appreciation of our calling we can carry on an aggressive warfare that will eventually result in the extermination of nostrum manufacturers and irresponsible practitioners.

DISCUSSION.

Dr. Dawbarn was called upon by the president, and stated that while in the main he cordially agreed with the thoughts as expressed by Dr. Hopkins, yet he must differ regarding the view expressed as against the use of cocaine in surgery because of its danger. There is no drug of real value to us which is not a two-edged sword, and capable, if misused, of doing harm. This argument might with equal force be brought against ether anæsthesia.

He thought the use of cocaine in surgery was on the increase, and, used carefully and with certain precautions, it was safe. Personally, he had had no case of poisoning from its use, almost daily,

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for a period of several years. His colleague, Dr. Wyeth, at the Polyclinic School and Hospital, uses it even more than he, and at times for major operations, such as amputation at the shoulder, and ligations of the subclavian artery, and regards a four-per-cent. solution as best for injection.

Dr. Dawbarn thought it a safe rule not to have more than one grain absorbed, and always precedes its injection by giving the patient a large drink of whiskey, or else a hypodermic injection of glonoin—also called trinitrin, and which comes in tablet-triturates of $\frac{1}{100}$ grain each—is given together with the cocaine. Either alcohol or glonoin will dilate blood-vessels, and thus balance the tendency of cocaine to contract them unduly and thus to cause anæmia of the brain.

Should symptoms of faintness arise, the patient should be placed flat, and given by the mouth two drachms of aromatic spirits of ammonia, in water, or more whiskey.

Whether, as Dr. Hopkins believes, there is a greater liability to unpleasant symptoms following the use of cocaine about the head than elsewhere he could not say.

Regarding the reference to Dr. Schleich, of Berlin, Dr. Dawbarn believed that his method of anæsthesia, produced by injection of extremely weak and almost infinitesimal doses of cocaine, is mainly a repetition of the work of Dr. Halsted, professor of surgery at the Johns Hopkins Hospital in Baltimore. Some twelve years ago he had seen Dr. Halsted remove a superficial tumor painlessly by the use of plain water injected into the skin surrounding the growth. Indeed, even before that time Bartholow, in his "Materia Medica," had, in the chapter upon "Aquapuncture," pointed out that water is anæsthetic to a considerable extent, and advised its use injected in contact with the sciatic nerve in obstinate sciatica.

Dr. Dawbarn remarked that he was greatly interested in electric cataphoresis, which he had used for opening felons, and similar conditions, a good many years ago. He believed that Dr. Frederick Peterson, who devised this term, credited him with being the first surgeon to do this. But it was a slow method, and he had subsequently employed cocaine, ethyl chloride, or other means, by preference. In dentistry, however, he could see the possibility of a brilliant future for electrolysis.

In conclusion, Dr. Dawbarn said that he should like to have the Institute take occasion to try one or all of the following anæsthetic drugs, hoping that among them may be found one superior to cocaine for dental work. These are—

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"*Tropsin*" (first described by Schweigger, of Berlin, see *New York Medical Record*, October 8, 1892). A three-per-cent. solution produces eye-anæsthesia more quickly than does the same strength of cocaine. It is obtained from the small-leaved cocoa-plant of Java. Chemically, tropsin is closely related to atropine, and is really benzoyl tropeine.

Brucine, obtained from nux vomica seeds; save that it is anæsthetic, it has the same action as strychnine, but is considerably less powerful than the latter.

Strophanthin, obtained from the seeds of strophanthus hispidus, which is the kombé arrow-poison of tropical Africa. Used internally, in proper dosage, strophanthus is a heart-tonic.

Erythrophlœine, from sassy bark (E. guineense), which is from Africa. Dr. Carl Koller, the discoverer of the properties of cocaine, has recommended it recently. (See *New York Medical Journal*, March 30, 1895.)

The President.—We will now have the pleasure of hearing from Dr. F. T. Van Woert, of Brooklyn, who has been kind enough to join us in this evening devoted to the consideration of "local anæsthesia," and who will not only relate his experience with cataphoresis, but will also exhibit the apparatus he uses, some portions of which, I understand, he devised.

Dr. Van Woert.—I want, in beginning, to correct the impression left by the remarks made by Dr. Bogue. From what he has said it might be inferred that the Wheeler apparatus for cataphoric medication is absolutely worthless. On the contrary, I know from practical experience that perfect results can be obtained by its use, and my only objection to it is that it is not quite as practical and handy for dental purposes as we could wish. The time consumed in its use is considerably longer than need be, and there is no positive accuracy in its registration.

The instrument which I have to present to you this evening has a maximum voltage of thirty-one and a half, or one and a half volts to a cell, there being twenty-one cells in the outfit. I am not in favor of the use of the street current for this purpose, and I find it is unnecessary, because the voltage required is so small, averaging from five to nine volts only, that the batteries are very much preferable and certainly are safer. The general construction of the instrument is such that the amount of pressure and the volume of current used can be divided and read without a technical knowledge of electricity; and to my mind the use of the milliampère meter, as well as the graduation of the current-controller, is absolutely neces-

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sary to the successful use of electricity for cataphoric medication. For instance, a patient presents himself, and we find upon application of the current a resistance of one-tenth of a milliampère in volume against less than a volt in pressure. There can be no doubt that the resistance in this case is so high that it will consume a great deal more time than one where the milliampère meter would register three-fifths of a milliampère against three to five volts in pressure; from which you can readily see the necessity of being able to know the amount of pressure and the volume of current passing through the tooth. After my few months experience I feel that I am able to tell almost to a moment how long it is going to take to anæsthetize the part, simply by comparing the volume against the pressure of current consumed.

One of the most important factors in cataphoric medication is the proper conductibility of the medicament used. Professor Morton has recommended the use of guaiacol in connection with cocaine. Guaiacol I find, like all of the oils or fats, is an absolute non-conductor, and unless sulphuric acid or some chemical having high conductive properties is added, it would be of little use. I find in my practice the best results are obtained from an aqueous solution,—thirty per cent.,—or a saturated solution, of cocaine, with a very slight trace of chloride of sodium. The conductibility of plain water with a pressure of thirty-one and a half volts is just three-tenths of a milliampère to the half drachm,—that is to say, when thirty-one and a half volts are running through half a drachm of water the milliampère meter will show three tenths of a milliampère, and a milliampère is a thousandth part of an ampère. Thus you can see that water is a very poor conductor.

It has been stated that bleaching of teeth is very much facilitated by the use of the electric current, and it is recommended that a twenty-five-per-cent. solution of pyrozone be used. Upon careful experiment you will find that pyrozone solutions, either five per cent. or twenty-five per cent., are absolute non-conductors, and the addition of the electric fluid does not hasten or facilitate the operation in the least.

One of the most difficult obstacles to overcome is found in the application of the current to the tooth. If it is to be necessary for a busy man to stand with an electrode in his hand from five to thirty minutes, that will very soon place cataphoresis on the top shelf in the back office. To overcome this difficulty I have devised several electrodes, made from German silver spring wire, which can be snapped into place and allowed to hang without the aid of an

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assistant, and the operator, after adjusting them, may proceed with other obligations of the day, leaving to the office-boy, girl, or assistant such slight additions of current as the case may require. Personally, I arrange my appointments so that patients with sensitive teeth that need this anæsthetizing process shall present themselves at least one hour before I am ready for the operation. I place them in an ordinary chair, give them something interesting to read or look at, and after applying the dam and making the proper connections with the apparatus, I go on with other appointments, leaving the patient in charge of my young lady assistant during any time that I may be occupied prior to their taking the operating-chair; then, when I am ready for the operation, the teeth are absolutely insensible to the feeling, and I am able to excavate and fill without the least demonstration on the part of the patient, from which you can understand that the time consumed in the operation will be at least one-third, if not one-half, less than if I were to attempt it without anæsthetizing the part. The only objection raised against cataphoresis is the time that it consumes, and if the time saved in the possibility of rapid operations following the cataphoric application be placed against the time consumed in its use, you will find that, by deducting the former from the latter, the time consumed in all will be very little more than it would be if electricity were not used, to say nothing of the great relief from nervous strain to operator and patient. I have come to look upon my Saturday mornings with as much comfort and freedom as any other day in the week since the introduction of this method, while prior to that time Saturday was a skeleton in my closet, and I have felt for many years that if I could ever acquire a competency, I would abandon the treatment and filling of children's teeth.

The anæsthesia of sensitive dentine and the extirpation of living pulps form a small part only of the uses to which this apparatus may be put. In the treatment of pyorrhœa alveolaris I make an application of cocaine to the soft and hard tissues for from five to ten minutes, after which I am able to cut and scrape to my heart's content without interference because of pain to the patient. Again if a case of acute pericementitis comes into the office, I immediately apply a half strength tincture of iodine by means of one of the little cup electrodes which you see here, giving about twelve or fifteen volts from three to five minutes, and if you try that you will find that in the majority of cases the pain will cease in a very few moments and the trouble entirely disappear. There are other cases in which cataphoresis may be usefully employed, as in the introduc-

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tion of sterilizing or germicidal agents into the roots and tubuli of the teeth, the deposition of a compound of zinc and copper, known as electrolysis, for the destroying of sacs where pus is forming, better known as alveolar abscesses, and in suppurative processes, such as pyorrhœa alveolaris. In short, the field seems to be unlimited, and I can hardly realize where it will end.

I shall be very glad to carefully go over the details of this matter, and the instruments presented, with any of the individual members after the meeting, and I may say that it is utterly impossible to give a description extemporaneously and without preparation which every one would understand.

I feel sure that cataphoresis has come to stay in dentistry. The man who practises without it is going to be considered a back number within a very few months, and he will find his patients drifting around the corner to Dr. Jones, his neighbor, for the relief which humanity has been seeking ever since science was known.

The president personally thanked all who had taken part in the meeting, and congratulated the Institute upon the large attendance and the great interest shown.

The Institute passed a vote of thanks to Drs. Dawbarn, Hopkins, and Van Woert for their valuable contributions.

Adjourned.

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A MEETING of the Institute was held at the residence of Dr. C. W. Meloney, No. 54 West Forty-eighth Street, New York, Tuesday evening, June 2, 1896, Dr. Benjamin Lord, President, in the chair.

The minutes of the previous meeting were read and approved.

Upon the call for communications from committees, Dr. Bogue, chairman of the Committee on Operative Dentistry, responded.

Dr. E. A. Bogue.—If the President will permit me, I would like to ask Dr. McNaughton to read his part of the report.

Dr. S. H. McNaughton.—The preparation with which I have had some success as an obtundent is composed of equal parts of cocaine and thymol, made by heating the two in a test-tube, the thymol being melted, and this in turn dissolved the cocaine; or it may be made by grinding the two together, a thick syrupy fluid being the result. For sensitive dentine, I use it by placing a piece of asbestos paper saturated with it in the cavity and over as broad a surface as possible, covering this with zinc phosphate, and allowing it to remain two or three days or more.

Harlan and others have shown that medicaments placed in the pulp-canal will traverse entirely through the dentine and cementum; that some substances do enter the living dentine is proved by the discoloration produced by amalgam fillings, by nicotine, by cannabis indica; it seems more than likely that arsenous acid is carried into the dentine by the living matter of the tooth. We often observe, just as the rubber dam is removed from teeth, that the teeth most thoroughly dried out by hot air have a lighter or whiter appearance; especially is this the case if an oil has been used to saturate the dentine. After a time the natural color returns. There has evidently been some change in the amount of moisture in the tooth, so that the theory of absorption of cocaine by dentine may not be a far-fetched one, especially as it seems to be conceded that by cataphoresis cocaine may be forced into the tissues.

Some cases have seemed to prove that the compound cocaine and thymol is really an obtundent. I shall only give two or three.

CASE I.—Mrs. P.—Cavity in distal surface of superior bicuspid; began to prepare for filling, but finding it exceedingly sensitive, applied the cocaine mixture; she returned two or three days later, and there was almost no pain in thoroughly preparing the cavity. She said it was worth an extra trip from Yonkers.

CASE II.—I had partially prepared a very sensitive cavity in the lateral incisor when a cavity was discovered in the central, and as my next patient had already come, I placed in the cavity in the

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lateral some of the cocaine and thymol covered with zinc-phosphate and made an appointment for three days later. At this sitting, when the preparation of the cavity in the lateral was completed, he asked if that was the same tooth that had been so sensitive the previous day, and, on being told that it was, said that nearly all tenderness had disappeared. He did not know of my using any obtundent.

Case III.—Young lady, aged twenty. I attempted to prepare approximal cavities in bicuspid and molar, but found both to be so extremely sensitive that I could do almost nothing. An application of the cocaine and thymol was made and covered with gutta-percha, and these were not again operated upon for over two weeks. The sensitiveness was somewhat lessened, and I was enabled to prepare both cavities to my satisfaction; but of all the cases I have tried where the preparation has been in two days or more, I consider this the nearest to failure. I think, perhaps, that the cocaine had leaked from under the filling, or that possibly enough had not been used, and perhaps too much time had elapsed.

I relate these cases believing the cocaine and thymol compound to be of assistance. The addition of potash to devitalizing mixture hastens its action, but it needs to be used with great caution.

Some of the other uses to which the cocaine and thymol may be put are to saturate pulp-canals, and to anæsthetize the tissue beyond the foramen preparatory to filling a root, to protect sensitive dentine while operating, as a vehicle for arsenous acid, etc.

Dr. E. A. Bogue.—Your Committee on Operative Dentistry begs to call attention to some of the recent utterances in regard to cataphoresis, both for local anæsthesia and for the bleaching of discolored teeth, and to give the results of a few experiments with the volt-selector, furnished by the Electro-Therapeutic Company.

It must be borne in mind that the most sensitive cavities with which we have to deal are those at or near the margin of the gum, or along the line of demarcation between the enamel and the dentine. When that line shall have been passed, the sensitiveness in any given tooth diminishes. The most difficult cavities to excavate and those most in need of obtundents are those between the teeth, and this is where cataphoresis is always difficult to apply, and most ineffective, if applied, so that it has been impossible for the writer to utilize it to advantage in this class of cases, excepting in readily accessible cavities in incisor teeth.

In those neglected cavities where, as Dr. Morton said, "the leathery substance at the bottom of the cavity can be peeled up, oftentimes exposing a sensitive zone," this mode of cataphoric

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obtunding is easily applicable. But the peeling up process (again according to Dr. Morton), even after the cocaine has been driven in electrically, gives so much pain that the writer wishes it might have been done before applying cataphoresis.

Neglectful patients are not generally the over-sensitive variety, but those who make immediate application for relief in case of any known defect in their teeth are the ones who are delicate and sensitive to the last degree, and who most need all the relief that can be procured. For that class of patients cataphoresis seems of little value.

It has another drawback that was strongly insisted upon by Dr. Morton at a recent Odontological Society meeting, and the writer cannot do better than to emphasize his warning. He said in substance, "It is astonishing how sensitive the nerves of a tooth are to even the slightest electric current; even one-half a volt is acutely felt, and a single cell of the Leclanché battery causes pain." This is quite true, and it limits the application of the instrument to a comparatively small number of cases, and these are the ones that need it least. The writer will enumerate few of the cases in which he used the volt-selector.

Mrs. T., a lady of perhaps fifty-five years of age; so intolerant of pain that when she first presented herself for treatment, five years ago, she would not allow an explorer to be put against the neck of the tooth, or into the cavities, without flinching so much as to render an accurate examination impossible. At that time the cavities in her teeth were obtunded with hot air first, and that was followed by pure carbolic acid and cocaine.

In certain proximate cavities where hot air could not be introduced, after drying the cavities as well as possible, carbolic acid and cocaine were first used, and afterwards zinc chloride in crystals, allowing these crystals to deliquesce in the cavity. This process has given excellent results in a larger number of cases than anything else that the writer is acquainted with, and these two methods have been pursued by him during the last twelve or fifteen years.

The lady whose case is now being described refers to the process as "the hot air treatment." A few days since a twenty-per-cent. solution of cocaine was applied with the electric current. The patient reported that the tooth was slightly sensitive to the operation, but it took about twenty minutes with a very disagreeable sensation to accomplish the same results that had always been accomplished for her by the "hot air process," as she called it. The

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second time that the selector was used, she declared very positively that her preference was for "hot air," and the applications that went with it. As this declaration was made when a cavity was but partially prepared, it was finished by using carbolic acid and cocaine followed by chloride of zinc, which accomplished the desired result, the tooth being excavated without further pain.

D. D., a brave little boy, ten years old; left upper molar; approximate cavity; exceedingly sensitive; necessary to fill where the temporary tooth, which had just fallen, had left space enough to work in.

Application of hot air gave pain for the moment; applied the cocaine solution (twenty per cent.) with the volt-selector, and the boy complained at every turn of the regulator, every increase of voltage, however minute; not that he was being hurt especially, but that the sensation was so disagreeable as to make him cry out.

After nine minutes of current, during which the indicator went up to "six," the current was discontinued; sensitiveness was diminished for a slight depth at the margin between dentine and enamel, but before all the decay had been removed the boy was bitterly complaining of being hurt.

Finished by applying chloride of zinc in crystals, which soon gave the ability to finish the excavation.

Mrs. E. said that the electric current was far worse than the pain of the tooth; that it was a very disagreeable feeling, and made her arm lame for a long time afterwards; she also said that, as a general thing, after a tooth was filled she heard nothing more about it, but in this case, the tooth operated upon ached for a day or so afterwards.

Mrs. J. said the first time that the writer used the electric current there was an alleviation of sensitiveness, and the work was much more easily performed. The second time she said she did not see much difference between that and the old way of doing, but was willing to have whichever way the operator said was better.

Cataphoresis has been successfully tried in four cases of bleaching,—three central incisors and one lateral. The lateral was considerably discolored with a bluish tint, arising evidently from extravasated blood in the pulp-chamber, which extravasation caused the bursting of the blood-corpuscles and the dissemination of the hæmoglobin into the dentinal tubes. The diagnosis of this condition was very clear after the tooth had been opened, because about one-third or one-half of the pulp was found alive, the rest dead. The other three teeth were yellowish, one of them having abscessed

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and having the pulp-chamber full of pus when the drill struck it; the other two teeth were yellow through the effects of a blow received many years previously, which had evidently destroyed both pulps. These three central incisors were all nicely bleached in from twenty to thirty minutes, but the lateral took an hour and required a voltage of "37" of the volt-selector, producing an amount of heat that was very perceptible to the operator as well as the patient. A professional friend, who assisted at these operations, gave it as his opinion that he had himself produced equally good results in bleaching by the use of hot air for drying the cavities first, and then pyrozone, without the electric current. Now the reason of this partial success is not far to seek. When the electric current is passing through a portion of the living organism, it naturally encounters different degrees of conductivity on the part of the tissues through which it passes. When the positive electrode is placed inside the cavity of a tooth, which tooth is composed of dentine somewhat analogous to ivory, enamel, still more a non-conductor, and cementum, a bony structure, it cannot be supposed that the current will follow any but the lines of least resistance, and it cannot be supposed that the same result can be obtained through a non-conducting substance that can be reached through nerve and muscle, or even through skin when moistened.

Dr. Morton, to whom the writer is indebted for his knowledge on this subject, says that he is profoundly ignorant of all strictly dental matters. Your committee would certainly not be so impolite as to contradict this assertion, especially in view of a little zone in one of the teeth which was bleached that for a long time resisted the bleaching agency. Why was this? It cannot, perhaps, be proved without more extended experiment, but it seems quite explicable upon the ground that the electric current was following out the line of least resistance, and so leaving certain dentinal tubuli that were off the direct line unaffected, until capillary attraction and osmosis eventually, after two or three days, did the work. Another local anæsthetic that does not seem to be very generally used among dentists, but nevertheless is of great value, is chloride of ethyl.

This substance has been more and more used in hospitals for the last six or seven years, in minor surgical operations, such as opening abscesses, amputation of fingers, and the removal of small growths, as well as for the extraction of teeth. Being put up in small glass tubes with brass caps over the orifice, no especial apparatus is required for its use. It evaporates so rapidly that the

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freezing-point is reached sometimes inside of two minutes, and anæsthesia generally in one minute if the surface is dry. What results may be reached in the near future with the help of the electric current we do not know, but up to the present the much-talked-of volt-selector must take its place as one of the many instrumentalities for local anæsthesia, and not pre-eminent for its safety or rapidity of action.

Dr. Brunton, of Leeds, recently sent the writer a little lamp in the wick of which is a coil of platinum wire to equalize the flame and prevent the lamp going out. A shaving an inch and a quarter long, cut from a platinum plate of No. 30 gauge, would answer very well, and could be attached to the wick of any lamp. It is rather efficient.

The attention of the chairman of this committee was called by Dr. Davenport to a method of banding teeth with gold, described in a paper by Dr. J. F. Adams and published in the *Digest* for January, 1896. Dr. Davenport seems to think that Dr. Adams's advice should be noticed by our members. The writer is pleased to say that eleven years ago a patient came into his office with a tooth banded in very much the same way by Dr. Allport, of Chicago, and that tooth was in good condition a few weeks ago. The writer has had two other teeth bleached since this paper was written, both of which have been bleached without the volt-selector, and so far as can be seen the results attained have been as good as with the volt-selector. It took, however, a little more time to do it. Dr. J. G. Palmer bleached two central incisors in the mouth of an English lady, who was written to, inquiring about them, and the answer to that letter stated that her teeth were gradually turning black, and she was very much disheartened. With Dr. Palmer's permission the patient was invited to the office of the writer, and it was found that a point not larger than the puncture that a small pin would make in paper, where the gold showed through the enamel, exhibited a dark spot; for the rest of it, the bleaching which Dr. Palmer did for her was admirable and was staying well.

The President.—The report of the Committee on Operative Dentistry is now before the meeting for discussion.

Dr. Charles F. Allan.—In the light of my personal experience the past three or four weeks, the report of Dr. Bogue and the remarks of Dr. McNaughton just made seem to me like ancient history. Cataphoresis has come to stay. The Wheeler volt-selector, upon which the doctor's remarks have been mainly predicted, I have never used and cannot criticise, but with the machine which

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is before us to-night I know we have a means of controlling the sensitiveness of dentine, and many other sensitive conditions of the oral cavity, which is simply perfect,—that is, absolute. We have only one idiosyncrasy to combat, and that is the peculiar, varying quality of the teeth of the individual to conduct electricity, but the result is sure. It is not only that in the end we have complete anæsthesia, but it is a fact also that the process itself gives no pain.

I think the main trouble in using the machine seen here (the Van Woert cataphoric machine) has been that too generally the operator uses all of the cells. I find that is ordinarily not best; generally half of the cells will do the work.

There has been with me the radical difference in making complete anæsthesia in some cases of from six minutes to forty-five minutes, the latter case being one to which I think I referred at our last meeting; and I think I said also at that time that I was quite certain that when I had that patient again in my chair the time would be very much abridged. This has proved to be the case; a very deep coronal and proximate cavity in a bicuspid tooth was completely anæsthetized in fifteen minutes. The average time taken by me has certainly not been over twenty minutes, and I would expect in the future to have it cut down to twelve or fifteen. By using judgment in the number of cells used, and of the way in which the current is turned on, no pain need be caused,—that is, no pain that the patient will complain of.

But there is another phase of the subject. I think every operator using this process will want to be very careful in the selection of his cases,—that is, cataphoresis should only be used where there is an urgent necessity for it. Complete anæsthesia loses to us the diagnostic indication of pain, which is almost invaluable in the preparation of so many cavities. In many ways pain is the very best diagnostic sign we have, and we should go but slowly in depriving ourselves of its valuable help. In all of my cases so far I have used a twenty-five-per-cent. solution of cocaine.

Dr. J. G. Palmer.—I think I can answer Dr. Allan's remarks concerning pyrozone, and make a few remarks referring to Dr. Bogue's. Dr. Van Woert was right regarding the conducting properties of twenty-five-per-cent. solution of pyrozone, the ethereal solution; but Dr. Morton has a way of making that solution an aqueous solution, by evaporating it, and the electric current will pass through it, and will do the work of bleaching quicker. I am very much in doubt as to its doing it any better than the

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ethereal solution used with warm air, but it will do it a great deal sooner. In the case which Dr. Bogue alluded to, of the English lady, he omitted to mention one fact, that in this tooth which she thought was darkening somewhat, there was a gold filling, not removed at the time of bleaching. All metals should be removed from the tooth to have the best results. The other tooth had no filling in it whatever. The discoloration she discovered was just a line of this gold filling that had been allowed to remain in the tooth. In the use of the selector I had better results than Dr. Bogue has had, probably because I selected easier and more accessible cavities. I stood by Dr. Bogue's chair, however, observing some of the experiments he has narrated, and I must confess that, despite my own success with the apparatus, he succeeded better with cocaine followed by zinc chloride, as described. I think Dr. Allan is well within bounds when he says the average would be about fifteen minutes. I have never been able to produce complete anæsthesia in less than seven minutes; if I remember, the majority of cases have been much more than that, and I am probably more convinced than Dr. Bogue that the selector will produce satisfactory results, but I have not been able to see it in any case, as Dr. Allan has, without producing pain. I doubt if I can do it without producing some pain in the operation. I have not used this one which Dr. Allan has. I thought that the pain was due to the fact that I was trying to obtund the tooth in less time than fifteen minutes. In cases where I prolonged it to twenty minutes, turning up from fourteen to fifteen volts, there was decided success. Dr. Brown reported at a meeting in New Jersey that he had with a combination of fifteen per cent. cocaine with electrozone been able to produce complete anæsthesia in a minute and a half. In at least three cases of my own there was complaint that there was a great degree of soreness and irritation, like that which is consequent upon a prolonged operation and where the ligature has to be forced under the gum, running over two or three days.

The President.—All must feel this is a most interesting subject. Will Dr. Brown, of Elizabeth, give us his experience and views?

Dr. G. Carleton Brown.—While feeling the honor you have conferred upon me by asking me to give my experience in cataphoresis to the Institute, I feel that there is really little for me to say that will be of benefit, as the more experience I have the less I seem to know about the matter.

Some time ago I reported some cases that I considered interesting to the Central Dental Association of New Jersey, among them

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being one in which I secured complete insensibility in one minute and a half. As this case has been considerably talked about, I wish to state that there was no chance for a mistake, as my assistant always manages the instrument and keeps a careful record of the time consumed in all operations. The cavity was a very sensitive one, being situated in the anterior cervical surface of the left inferior cuspid, and extending slightly under the margin of the gum. A fifteen-per-cent. solution of cocaine in meditrina (electrozone) was used, being applied to the gum for one minute and to the tooth for one-half a minute. This was done to enable me to put on the clamp painlessly, which was accomplished; and, finding that the tooth did not respond to the pressure of the clamp, I decided to start excavating, and see how far the tooth was really obtunded. To my surprise, I was able to excavate the entire cavity without the slightest pain.

A few days after reporting this case I filled the corresponding cavity in the opposite tooth, and to secure the same anæsthesia I had to keep the current on for fifteen minutes. The conditions were apparently the same, and what caused the difference I am unable to say. But while we do meet with these occasional reverses, still the ratio of successful cases is increasing, as any one may prove by keeping a careful record of all cases, failures as well as successes.

In regard to the average time required to produce the necessary insensibility, I think that Dr. Allan's fifteen minutes is more than is necessary; in most cases we are all apt, I think, to keep the current on longer than is really required, and time can often be saved by making several short applications rather than one long one. There is a tendency which I think should be carefully guarded against,—the inclination to use cataphoresis in a great many cases where it is unnecessary.

Dr. Bogue.—I would like to ask Dr. Brown whether in that minute and a half cataphoric case, using cocaine and ether and his cavity being at the margin of the gum, he took into account the fact that cocaine acts centrifugally and not centripetally, and acts to the peripheral extent of the nerves and not towards the centre.

Dr. Brown.—That might perhaps explain it; but, as I stated in my remarks, I applied the current first to the gum and afterwards to the tooth. I would not expect to get any effect on the tooth if I applied it to the tooth and the gum at the same time, as the whole electric force would, I think, pass through the gum.

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The President.—Are there any further remarks to be made on this subject?

Dr. Milton F. Smith.—May I inquire what solution Drs. Palmer and Allan used; was it the aqueous solution?

Dr. Palmer.—I used the twenty-five-per-cent. aqueous solution.

Dr. Smith.—Have either used the cocaine with tincture of opium? My friend, Dr. Jas. P. Holder, says his best results have been secured with the solution of cocaine with tincture of opium instead of water. He also reported to me two cases in which he removed two pulps, and, he thought, painlessly. I am quite interested in that part of cataphoresis; it seems to me if we can do that, we certainly have made great progress in getting rid of arsenic, which some of us unfortunately are obliged to use.

The President.—It gives me pleasure to state that Professor Dawbarn has consented to speak for a few minutes this evening upon the subject of malignant growths. Will he kindly favor us now?

Dr. R. H. M. Dawbarn.—This subject of malignant growths is too extended for thorough treatment in a few minutes, and I do not know just what points you want to cover. What little I know about the matter might better come in clinical demonstration than as a didactic lecture; this is more matter for a long, formal essay than for a five minutes talk. However, I have here a growth which illustrates a number of points which should be of practical value to all of us. This is an upper jaw taken from a young gentleman of this State. The case was sent to me by Dr. Howe of this Institute, and was a very interesting one in a number of ways. I think when you examine the growth you will say that its superficial manifestation would not have justified a diagnosis of any such degree of malignancy and size of tumor as actually existed; the antrum being entirely filled.

The President.—Dr. Dawbarn will be very glad to be questioned later on the matter that he proposes to bring before us.

Dr. Dawbarn.—This case presented the following history: About a year ago or a trifle less this young gentleman, aged twenty-five, had trouble with the second bicuspid of his upper jaw, which ached for a considerable time and ultimately was drawn by a dentist in the town where he lived, not far from New York. On close questioning, the patient remembered, when he finally came to me, a very interesting point,—namely, that he had noticed that the end of the fang of the extracted tooth was soft instead of being of the usual petrous character. The dentist had commented on this as being

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odd, but nothing was thought about the matter. The discomfort continued,—not suffering, simply a feeling of discomfort there. Because of that feeling of discomfort, and because of a slight fulness in the roof of the mouth that he had noticed in the last two or three months, he went to Dr. Howe, who felt sure there was a serious condition. I think he was of opinion that there was a tumor; and he sent him to me.

I must say that when the young man presented himself to me there was little wrong to be observed. He was a rather full-faced individual, and such slight prominence above the alveolus as existed was not noticeable except on comparing the two sides. The roof of the mouth on that side was a trifle swollen in appearance. He had no cachexia, such as one frequently sees in the late stages of malignant disease. I made my diagnosis, as I have repeatedly done, partly by aid of a hypodermic needle. I ran the hypodermic needle into what should be solid bone, and it went straight through. I propose, if you will permit me, to demonstrate this with a pin. Now, it is self-evident to any of us that there should here be the densest kind of dense bone; but in this case the pin goes straight through, you see, and meets only about the resistance of ordinary cartilage; you see how little there is to show for it,—a little swelling here in the roof of the mouth and again above the alveolus, over the antrum of Highmore, just behind the canine fossa. Thus far I had not made the diagnosis more than a presumptive one, as this softening might have been due, for instance, to osteoporosis accompanying an inflammatory condition there; but if there had been such a degree of osteitis with softening there would probably have been a previous clinical evidence of it, such as suppuration, an ulcerated root, or some other evidence of inflammatory bone lesion; and there was nothing of that kind. Then, too, if it had been merely a superficial softening from chronic inflammation of bone over the antrum, when the needle was pushed in through this very thin shell of bone I should have been able to move it with perfect ease; but instead of entering an air-space it was being pushed for the whole length of the needle into a solid mass; so it was evident that there was a large tumor there. Now, as to the variety of tumor, that was another matter. It might be a sarcoma, of several varieties; it might be odontoma, one of some half a dozen kinds; it might be a fibroma, an enchondroma, etc. As to odontoma, one small point is worth observing,—namely, that this man had a complete set of teeth, with none missing, except the one recently extracted. Now,

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in odontoma one regularly expects to miss a tooth; and pretty commonly the growth has developed from this tooth-follicle as a starting-point.

In order to make sure of the nature of the tumor, I cut from it a small piece, say, a centimetre long and a half centimetre in width, and sent it to a prominent pathologist, Dr. Ely, the president of the Pathological Society. He said it was a small spindle-celled sarcoma, and of an unusually malignant type. It is probably an epulis in origin, springing from the socket of the tooth that was extracted, and involving and softening the fang of that tooth, a microscopic examination of which would have enabled an early diagnosis to be reached. The growth filled the antrum simply because this happened to be the direction of least resistance. Now, of course, it became a matter for prompt operation. I determined to give him every chance I could of not having a recurrence; therefore I not only excised the entire upper jaw, but also completely excised the external carotid arteries on both sides, first tying in each instance all of its eight branches. Thereby the region formerly occupied by the growth becomes comparatively starved in blood-supply; and the fact seems of value in preventing return of the malignant growth.

The patient did well, and is now attending to his law practice, wearing a prosthetic appliance made by a member of this Institute.

Let us now compare this case with a rather similar one, showing that you cannot make your diagnosis by softening only (though that is of great importance, and if a dentist meets with a case where he can pass a needle or pin into what should be hard bone, it is high time that a surgical consultation should be held). A dentist of a near-by city told that young gentleman that he didn't believe there was anything serious the matter, and advised him not to go to a surgeon. Softening alone is not sufficient to enable one to make a diagnosis of a malignant condition there. Another little history will be in order. Dr. R. M. Davenport, of this city, sent to me two or three weeks ago a young lady who for a long while had been troubled with an ulcerated tooth. Perhaps Dr. Davenport would like to give the history of that case.

Dr. R. M. Davenport.—The lady came to me about the last of January, troubled with a discharge from an opening over the right superior molar. The abscess discharged two or three times a day, and sometimes oftener. Although the fistulous opening was over the molar, direct entrance to the abscess was made through the

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second bicuspid, which had been syringed out for some time by a dentist in the country. He filled the tooth, but a recurrence of the discharge followed almost immediately. I removed the filling, syringing with hydrogen dioxide and dilute sulphuric acid, which came out through the fistulous opening, but the abscess did not seem to get any better. The last injection of sulphuric acid came out through the nose, showing unquestionably that the trouble had gone through into the antrum. I then took the patient to Dr. Dawbarn.

Dr. Dawbarn.—Then, Mr. President,—continuing the history of this case,—when I examined the young lady, I noticed, and she herself had observed, that the bone of the roof of the mouth and that over the antrum was distinctly softened, so much so that with the fingers on both spots a sense of fluctuation could be observed apparently transmitted by fluid in the antrum. It was obvious that chronic inflammatory change (osteoporosis) had led to this bone-softening. After the operation I found that a needle would as easily penetrate the bone as in the instance of the patient with sarcoma, just discussed.

It was not necessary to examine the antrum by electric light, prior to operation, to make sure whether or not it was involved, because in this case we were sure of it, Dr. Davenport having observed upon at least one occasion that fluid which he injected into the root of the tooth most involved escaped from the nose on the same side.

About ten days ago I operated upon her, Drs. Davenport and Williamson assisting, using ether anæsthesia. I removed by gouge and chisel all bone obviously compromised, not by softening, but by suppurative involvement. The tooth-root, which had apparently been the starting-point of all the trouble, was chiselled across (and at a later date Dr. Davenport filled what little was left of the root), and the false passage into the antrum was freely enough enlarged to permit the entrance of the little finger. The antrum was irrigated with a saturated solution of boric acid and drained.

The subsequent history was uneventful. Healing was rapid. The drainage-opening is now nearly closed, and is no longer needed. Even in these ten days' time there is distinct resumption of rigidity by the adjacent bone which had formerly been softened.[1]

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[1] At the time this goes to press—a few weeks later—the bone is absolutely as rigid as ever.

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The President.—We trust that Dr. Dawbarn will not feel hurried, if he has any further remarks to make; if not, he surely is willing to be questioned.

Dr. Allan.—With a tumor present, is there any symptom or group of symptoms that would enable a physician to say to a patient, "If you don't submit to this treatment you will have cancer?"

Dr. Dawbarn.—No; several kinds of benign growths are capable at any time of taking on malignant characteristics. A tumor is not a safe thing to have, though at the time a patient comes to you it is purely a benign one. It may remain so, or else from unknown causes may, in several varieties, develop into carcinoma or sarcoma.

Dr. Allan.—I know a gentleman, about fifty years of age, who has little points of growth in the side of the lower jaw. Some of the points may be as big as the end of my little finger, and from that down to the size of a pea; he has had these all the time he has been a patient of mine, some ten or twelve years; they are growing slowly. As long as they are quiet and not troublesome, may they not as well be left alone?

Dr. Dawbarn.—I think it would be wise to have one of them excised and examined by a pathologist. Probably they are simple osteomata and benign; but it is safest to make sure that no doubtful elements exist.

Dr. J. Morgan Howe.—I would like, if possible, to emphasize what Dr. Dawbarn has said, by calling attention to the necessity of our being familiar with the signs of disease, or at least suspicious of unfamiliar conditions, in order that we may not fall into the error that the gentleman did who examined this young man's mouth just before I did. The patient had been under the observation of a dentist and a physician for nearly six months, the second superior bicuspid having been removed last November. It was thought at the time that it was the cause of the tumor; but the swelling, he said, did not subside, and although he went back several times to both dentist and physician, he was assured up to the last that there was nothing serious the matter. I would like to say why I thought there was a suspicious and alarming condition. In the first place, the socket of the extracted tooth had not absorbed in the least; there was no shrinkage, and the cavity from which the root came was filled with a new growth of soft tissue. Next, I could easily and quickly exclude, as the cause of the tumor, all influence of the remaining teeth. They seemed to be in a normal

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condition, although loose; two molars and one bicuspid—the second having been removed—yielded to firm pressure in every direction without being sore, and the yielding was the giving of the socket to pressure, not looseness of the teeth *in* the socket. The swelling simulated an abscess in appearance, but was different from an abscess to the touch; pressure with the finger evidenced no pus, and there was an india-rubber-like elasticity, a resiliency different from the feeling of an abscessed tooth. Every dentist should have been suspicious of tumor in that locality, or connected with the teeth, not caused by the teeth, for if the dentist cannot find a cause in the teeth for the trouble, he should always be suspicious. The patient said the tumor had been lanced, but was not certain that any pus came away. I inserted a very thin bistoury into the tumor in three places, not expecting to get any discharge of pus, but to test the feeling of the yielding bony tissue. The bone seemed quite decalcified, so that I pierced it without any difficulty. This was another remarkable condition. There was one symptom lacking which I would have expected to find in a case of malignant disease. This young man had no pain of any serious character, but as I had known of many cancerous growths progressing to a considerable extent without causing great pain, I did not think that excluded the probability of this being a malignant growth. I would like, while I am on my feet, to refer to a similar case that came under my observation several years ago. The young man had been under the observation of a prominent dentist in this city for some months, and also of a prominent surgeon, but they neither of them seemed to suspect there was anything serious the matter. The patient said they discussed over and over again whether they should take out one of his molar teeth or not. When I saw him, two molar teeth were loose, in a very similar way to the loosening in the case of Dr. Dawbarn's recent operation. I informed this patient that the case was serious, and it being in Dr. Garretson's lifetime, I persuaded him to go that afternoon to Philadelphia. He was operated upon the next day, and the results were similar to those in Dr. Dawbarn's case, in that it was necessary to remove the entire upper jaw of one side; the disease recurred in six months, and he died within a year.

The President.—Does Dr. R. M. Davenport know anything further of the history of his case?

Dr. Davenport.—I know very little: the first bicuspid was removed when the patient was about fourteen, and the pulp in the second bicuspid was devitalized and the tooth filled. About a year after it was filled this abscess formed,—about four years ago.

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Dr. Wendell C. Phillips.—I have enjoyed listening to what Dr. Dawbarn has said this evening, having had considerable experience with malignant growths in the vicinity of the nose, and I am always interested in anything Dr. Dawbarn has to offer in connection with his work as a surgeon. I rise to ask two questions, and if the president will pardon a few suggestions I will be glad to offer them. Did Dr. Dawbarn make a careful examination of the nasal cavities as to whether the man had any polyps, and were there any eye symptoms? I have seen quite a number of cases of malignant growth of the superior maxillary bone, and have found that the insidious commencement of this especial form of malignant disease, which is quite different from what we ordinarily speak of as cancer, allows the disease to get very deep hold on the patient before any special notice has been taken of the growth itself. It seems that these cases of sarcoma rarely give any pain until the growth gets large enough to cause pressure on the nerve-trunks. A patient came to me and I found several polyps in the nose, and instead of its being polyp structure the microscopical report came back that it was a sarcoma. It was primarily a sarcoma of the antrum, but the growth had already extended into the other sinuses, which is very common for it to do, and there was breaking down of bony structures. Of course it was fatal. Dr. Dawbarn has very wisely called our attention to-night to the necessity of taking precaution against recurrence. I know no form of cancer so liable to recurrence as sarcoma. I know no form that is any more surely fatal than is sarcoma. I don't mean to say that they all die, but nearly all do. Dr. Dawbarn has made every effort in this case to prevent recurrence, and the operation has certainly been very thorough. I am glad to hear Dr. Dawbarn speak so well of transillumination, which bears out my own experience. I recently heard a laryngologist say of it that it was good enough for a plaything, but he had never been able to discover that it is of any benefit. Had he known where to look for the light or dark spot, and known better the manipulation of the electrical appliances, he would have a little less trouble in getting favorable results. It was my pleasure to read the first paper upon this subject of transillumination before a dental society, in 1890, and the paper was published in the *Dental Cosmos* for January, 1891. The real secret of transillumination is to compare the influence of the reflected light in the two eyes and underneath them. As a rule, in antrum disease you will find darkness under the eye of the affected side, whereas upon the other side there will be a bright reflex.

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The President.—Unless some gentleman has some question to ask Dr. Dawbarn——

Dr. Jackson.—Will Dr. Dawbarn kindly tell us whether sarcoma originates from the periosteum or from some other tissue?

Dr. Dawbarn.—In answer to the gentleman who last spoke, I think there can be no question in this case, since the bicuspid root had softened, that this thing began in the tooth itself, or more likely in its socket. It has a rather restricted basis, and it is incorporated with the bone in the roof of the mouth, but has no real pedicle. I think, as to prognosis, that the patient has a fair prospect; for the reason that this is a small fusiform-cell sarcoma, and that particular variety of sarcoma may be encapsuled; and if you will notice the specimen before you, this has a distinct capsule; therefore, instead of leaving me in doubt as to when I had removed all that was abnormal, I had a positive guide. I feel fairly confident that I removed all the abnormal growth. Regarding Dr. Howe's point, as to the question of pain, I find that malignant growths are apt to be painful; and as to this growth one would expect, having seen the tumor, that it would be painful, being so large. *A priori* it would puzzle any one, as it did Dr. Howe and myself, that there should be no pain. Doubtless it was the fact of development within the antrum, where it was not subject to pressure, that prevented much suffering. It would be a very easy thing with the abundant space now here that I should cauterize it, should there be a recurrence, charring those diseased tissues, and doing it, if necessary, more than once. I think the results of the case will be quite good. Those cases in which recurrence is fatal are very apt to be ones in which the patients do not come back to the surgeon in time. As a mere prophecy, I have a great deal of hope that this man will entirely recover; he may have a recurrence, but even so, with prompt treatment I think the final result will be recovery.

Dr. Howe.—Mr. President, at the last meeting of the Institute, Dr. Van Woert made some remarks which seemed to me so incorrect and misleading that I should have replied to them at the time, but for the fact that the meeting was overcrowded with material, and I did not wish to take up the time that had been allotted to others. With your permission I will call attention to them now, and test the reliability of some of the statements. In regard to two substances, guaiacol and pyrozone,—five-per-cent. and twenty-five-per-cent. solutions,—he said they are "absolute non-conductors" of the electric current. I doubt it very much: I think there is no such thing as an absolute non-conductor; even those substances which

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are regarded as insulators have their resistivity recorded and tabulated; hard rubber and porcelain stand, I believe, at the head of the list as affording the greatest resistance; I do not know about liquids excepting water, its specific resistance is recorded. But on this point I wish to object to the use of the words "absolute non-conductor" as misleading. Then, speaking of bleaching with pyrozone, he said that "upon careful experiment you will find that pyrozone solutions, either five per cent. or twenty-five per cent., are absolute non-conductors, and the addition of the electric fluid does not hasten or facilitate the operation in the least." I have bleached teeth with a twenty-five-per-cent. solution of pyrozone by the aid of the electric current for over a year, and I have never had such good results without the electric current as I have had with it, and I believe from clinical experience that the electric current has helped very much. Dr. Van Woert said that pyrozone, both five- and twenty-five-per-cent. solutions, were "absolute non-conductors," and I understood that this was his reason for asserting it would not be cataphorically driven into the tooth. I will, with your permission, test it here for us all to see; it was proposed that I test it publicly, and I am very glad to do it. Now, gentlemen, Dr. Allan has poured some twenty-five-per-cent. pyrozone into a wide-mouthed bottle, and I have inserted two German-silver wires through the cork into that solution; they stand in the liquid on opposite sides of the vial; I will just touch the wires that are in the solution with the electrodes; there are five cells connected now. The wires now are in the solution of twenty-five-per-cent. pyrozone, and you see that one milliampère is recorded by the milliampère meter. If the wires were larger, or if they were nearer together, or if they were inserted farther into the liquid, or if more cells were connected, in either case it would record more,—more current would pass. Now, another statement that was made was, "the conductibility of plain water with a pressure of thirty-one and one-half volts is just one-tenth of a millimetre to the half-drachm,—that is to say, when thirty-one and one-half volts are running through half a drachm of water the milliampère needle will show one-tenth of a milliampère." Now I don't know what Dr. Van Woert meant by plain water; I find that distilled water offers much greater resistance than tap water does; the reason, of course, we may suppose is that the chlorides, nitrites, etc., dissolved in our ordinary croton increase its conductivity. Distilled water has a very high resistance, but Dr. Van Woert said *plain water*, and which of the two he meant I do not know, but he said there would

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be *so much current* running through a *certain amount* of water. That is, I think, misleading, because the quantity of water that surrounds the electrodes does not at all influence the passage of the current; it depends upon the size of the electrodes, the distance that they are apart, and the extent of surface that is immersed in the liquid. That is easily shown. We will take this bottle of distilled water that I have here and put this cork with these wires in its opposite sides into it. On touching the electrodes to the wires we have two milliampères recorded, as you can see, the current passing through the distilled water. Now I will put the wires in the cork into tap water, and you will see the difference between the distilled water and the tap water. Please note where the needle stands; as I wanted to show that the amount of current does not depend on the amount of water, I put them now into this glass of water; you see that they are in about ten times as much water as before; the needle stands just the same, because the wires stand in just the same relation and are inserted to the same depth. The two electrodes might be in the river, and the current would be the same that it is in this glass, if their relations were the same and it were the same water. The points I wanted to call attention to are the use of the words "absolute non-conductor," the positive statement that the current would not pass through the solutions of pyrozone, and the idea conveyed that the amount of liquid influenced the current. I might have shown as to the pyrozone that the three-per-cent. watery solution of pyrozone conducts about twice as well as distilled water, so that it appears that the peroxide of hydrogen increases the conductivity of water very much.

This is electrozone which Dr. Allan wants tested. It is a very good conductor; you will notice that the needle will get very much excited as soon as I touch the wires. We cut down the battery from thirty-one to five cells, and we still have more than the milameter can measure.

Dr. G. S. Allan.—That would explain the success Dr. Brown had using cocaine and ether in electrozone.

Dr. Howe.—If we are sure that conductibility is the thing to be desired.

Dr. G. S. Allan.—I think it probable that the conductibility of the bleaching agent employed will directly influence the results obtained.

Dr. Howe.—That remark of Dr. Allan's calls up to mind a thought that has come to me recently: that it may be we will find

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that the hydrochloride of eucaine, which is a new agent that has been tested abroad, and is made by Schering & Glatz, may be of service to us in producing anæsthesia of dentine; but I hope that electrozone may prove to be a help.

Dr. G. S. Allan.—And it would be necessary to use a weaker solution of cocaine in electrozone in order to obtain equal results.

Dr. Howe.—That may be, but still its conductive properties may be very different, and its action on dentine may be very different from what it is on soft tissue; all these things are matters for experiment rather than for arriving at conclusions by reasoning.

Adjourned.

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A REGULAR meeting of the Institute was held on Tuesday evening, October 6, 1896, at the house of Dr. C. A. Woodward, 49 West Forty-sixth Street, the President, Dr. Benjamin Lord, in the chair.

The President.—This being the first meeting after our summer vacation, it is naturally an occasion for congratulations and greetings, but we have also feelings of sorrow and sadness, owing to the fact that death has visited us and taken from among us our secretary, Dr. C. F. Ives.

We can only think of him as a warm-hearted friend, an interesting associate, and a faithful and efficient officer, one who was greatly interested in the work of the Institute, and we shall greatly miss both his companionship and his valuable services.

It will be most fitting and proper that a committee be chosen to prepare and present, at a proper time, a suitable memorial in behalf of the deceased, to be entered upon our minutes and to go into our proceedings. What is the pleasure of the meeting in regard to it?

Dr. George S. Allan.—Mr. President, we are, of course, of one mind and one thought upon this matter. Dr. Ives was a man deeply interested in our work, and we shall miss him the more as we come to know how much he was worth to us; especially those of us who knew how patiently he bore up under his physical suffering and who knew the pathetic story of his agony at times. He breathed no word of fault-finding or railing against the burdens that became at last too heavy. Whoever met him, whether in the office, in the street, or in society, always found him the same pleasant, genial associate. It will not do to take up our time this evening to pass upon his merits in words of eulogy, but your suggestion, Mr. President, is a proper and fitting one; and I would move that a committee be appointed to put in proper shape our thoughts and feelings, and to report at an early meeting.

Dr. Allan's motion was carried, and the President appointed, as such committee, Dr. Howe and Dr. Davenport.

The President requested Dr. Wilson to act as secretary for the evening.

The minutes of the last meeting were read and approved.

The President.—Dr. Davenport has a communication to offer, and we will be glad to hear from him now.

Dr. S. E. Davenport.—Intelligence of the death of Dr. E. A.

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Stebbins, of Shelburne Falls, Massachusetts, having recently been received, I beg the privilege of paying a short tribute to his sterling qualities and fine professional attainments.

A successful practitioner and an exceptionally fine operator, his fame was established throughout the profession because of original work done in two important directions,—carefully tabulated results of experiments concerning the relative value, strength, and durability of different materials and methods used in prosthetic dentistry, and the establishment of the use of nitrate of silver in daily practice on a scientific basis.

Nitrate of silver has, of course, long been used for cauterizing sensitive and eroded surfaces, but to Dr. Stebbins more than any other man does the profession owe its present knowledge of the great value of the nitrate of silver as an agent for the prevention and limitation of caries.

He made extensive experiments with it for a period of several years, and when his experience proved that it was of great value, particularly in the treatment of caries in children's teeth, he at once gave the profession the benefit of his deductions, at a considerable sacrifice, too, of time and money spent in attending distant society meetings for that purpose.

There is every possible incentive for dentists residing in large cities to engage in some form of original work, but when a man's lot is cast in a small town, as Dr. Stebbins's was, and he rises superior to the discouraging and non-appreciative influences surrounding him, and forces world-wide recognition from scientific men, the credit due him is certainly very great.

Dr. Stebbins was prominent in the different dental societies of his vicinity, and for a time president of the old Connecticut Valley Dental Society.

His death makes a vacancy in the ranks of the profession which cannot be filled.

The President.—Now for a few moments we will ask attention to the work of the committees. Dr. Bogue, the chairman of the Committee on Operative Dentistry, being absent, we will be glad to hear from any member of the committee.

Dr. George A. Wilson.—Being one of the committee on operative dentistry, whose report is now called for, and in the absence of its chairman, let me say, pursuant to the subject of the evening, —that of reducing the pain of our operations,—instead of a cataphoric instrument, which I have not tried, I have been using, for the past five years or more, chloroform applied on a pellet of cotton

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in the cavity, after placing on the rubber dam. It takes little time, acts rapidly, and very satisfactory results follow.

The President.—Will Dr. Wilson tell us how long a time is required to get the result?

Dr. Wilson.—From five to fifteen minutes may be required to reduce extreme sensitiveness. It hurts a little at first, but if the chloroform is applied *warm*, the sensitiveness soon subsides. If there are two cavities open at the same time, the application can be made to one while the other is operated upon. In this way absolute *dryness of the cavity* is secured,—the secret, perhaps, of pain reduction,—while the suggestion conveyed to the mind by slight inhalation also has, upon most patients, a seductive and soothing effect. It is a simple thing, and has proved very efficient, more so than any other remedy that I have tried.

The President.—We will now have the pleasure of listening to Dr. Wendell C. Phillips. He has no need of an introduction, for he has been with us before.

Dr. Wendell C. Phillips.—Mr. President and Gentlemen, I hope you will bear with me if I call your attention to what appears to have been an error in the report which your Committee on Current Literature published in the July number of the INTERNATIONAL DENTAL JOURNAL. It so happened that in that issue an article appears from my own pen, in which I make certain statements which are contradicted by your committee on current literature. I know you will do me the honor to give me an opportunity to defend the position which I take, and at the same time I know that, so far as your society is concerned, you are after the truth in all matters pertaining to cataphoresis. Now, in the article to which I refer I make the following statement: "A rheostat is an adjustable resistance introduced into the circuit in simple connection with the patient to control the quantity of current flowing, without regard to steady voltage. An adapter is an elaborated rheostat for use with the various street currents. A cell-selector is a series of contact points, over which travels a sliding switch-arm, each point connecting with one or more cells of a series battery. These cells ordinarily represent about two volts of pressure each." "The fractional volt-selector will give gradations of less than one-quarter of a volt," etc.

Now, gentlemen, I want to say that by actual test the fractional volt-selector will give not only gradations of less than one-quarter of a volt, but less than one-tenth of a volt. The report of your committee, to which I refer, says as follows: "Drs. Morton and

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Gillett bring forward the Wheeler volt-selector, an apparatus for turning on the current slowly; it is misnamed a volt-selector, and is merely a suitable rheostat."

Now, either your committee is at fault or Professor Morton, Dr. Gillett, and myself are at fault in that statement. Feeling sure that you would like to know which one is correct, I asked Mr. Wheeler to-night to bring the apparatus necessary to prove by ocular demonstration that the ground taken by Professor Morton, Dr. Gillett, and myself is the correct one. I might further say that it was Professor Morton's suggestion that gave the name of fractional volt-selector to this instrument. I do not know of any one who has had anything to do with electro-therapeutics who is more justly entitled to give a name to such an instrument than Professor Morton. The instrument referred to is not a rheostat, because it controls voltage in fractions.

The subject of the evening, "A Table of Differential Resistances of Fluids for Cataphoric Study," was then taken up, and an interesting discussion ensued, being participated in by Drs. Wendell C. Phillips, George S. Allan, J. Morgan Howe, Harry Waite, Mr. George M. Wheeler, and the President.

As the subject is to be continued at a future meeting a full report will be published at that time.

Adjourned.

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A MEETING of the Institute was held Friday evening, November 13, 1896, at the residence of Dr. S. H. McNaughton, 63 West Forty-ninth Street, New York City, the President, Dr. Benjamin Lord, in the chair. The minutes of the previous meeting were read and approved. Dr. Davenport read the following report of the special committee, appointed at the last meeting, in the matter of the death of Dr. C. F. Ives:

MR. PRESIDENT AND GENTLEMEN,—The sad death of Dr. Charles F. Ives, which was so feelingly spoken of at our last meeting, caused the appointment of your committee, and we desire to recommend that as a society we record our sense of loss, and our appreciation of his high personal and professional qualities, by entering this expression of them upon our minutes, and by making them a part of our transactions. We naturally recall the fact that he took the greatest interest from the beginning in the organization and proposed policy of this Institute, and that he was willing, notwithstanding the discouragements of failing health and consequent inability to attend to his practice, to assume the duties of secretary in our organization. He was born in New Haven, Conn., on October 5, 1829, and received his early education in that town. In his younger years he became a telegraph operator, and his acquaintance with a dentist and his interest in the mechanics of dentistry led him at that time to conclude to make it his vocation. He became a student of Dr. Perkins, the inventor of the Perkins operating-chair, and after a sufficient training practised successively in Waterville, Watertown, and Little Falls, N. Y. He remained seven years in the latter place, coming to New York about the year 1866. He exercised unusual skill and thoroughness in his professional work, and his services were characterized by sincerity of purpose and correct judgment. He was an expert in the forming and tempering of instruments, and was fond of exercising his art in this way. In his personal intercourse he was cordial and kindly, and always ready to undertake a task or duty for those to whom he was attached. He served the New York Odontological Society as secretary for several years, and later took the same duties upon himself here at our request. It will be remembered, also, how constantly at our social gatherings around the dinner-table he was chosen cashier without a murmur on his part. He had musical ability of no mean order, and for many years was an organist in church. Although naturally reserved and retiring, his intellectual and social qualities made him a desirable comrade to

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those with whom he felt acquainted, as we can all testify. His latter days were sad and lonesome, yet his independent spirit did not allow him to yield to the desire of friends to entertain him in order to cheer him. He died on September 14, 1896, and his body was interred at Champion, Jefferson County, in this State.

(Signed) J. MORGAN HOWE.
S. E. DAVENPORT.

On motion, the report of the committee was accepted and ordered on file.

COMMUNICATIONS ON THEORY AND PRACTICE.

The President.—We now come to communications on theory and practice. Any one present, whether a member of the society or not, who has anything new or of special interest, is invited to present it at this time.

Dr. Davenport.—While I hardly feel like beginning, it seems to me that this very important department of our evening's programme ought not to pass. It is said that we learn more from failures than from successes; and I should like to describe one of my failures, a failure of diagnosis. Fortunately, no damage was done, though, perhaps, the next time we would not be so fortunate. A gentleman consulted me a few days ago concerning a swelling about the roots of the first right superior molar. It had every appearance of an alveolar abscess in one of its primary stages; the tooth was slightly elongated, very tender to pressure, even of the tongue; the buccal side of the gum being considerably swollen, the palatine side a little. The other teeth in the vicinity were not tender to percussion. The patient, himself a dentist, agreed with my diagnosis, that the first molar was a tooth without a living pulp; and as there were no large fillings, and no history of recent work upon it, it seemed like one of those cases of dental suicide. With a sharp bur I began to drill through a small tin filling in the anterior part of the crown of the tooth; but as soon as the bur pierced the filling and entered the dentine, the patient winced, and not from the pressure. In short, the pulp was alive and apparently in a normal condition. There had been no error as to which tooth was the cause, or at least the centre of the trouble, for the others were perfectly comfortable to all tests. The patient is, perhaps, twenty-five years of age; gums healthy; no considerable amount of tartar in the mouth, and yet the history of that tooth for the last two days has caused the patient and myself to come to the

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conclusion that this is a calcic abscess, and that the pulp of the tooth is in no way involved. A very fine scaler introduced on the posterior side of the second buccal root discovered a few nodules of tartar a short distance above the normal margin of the gum, and becoming rather persuasive with the scaler, a little pus was finally reached. Hydrogen dioxide being used to syringe at that point, relief has come slowly. That was the only point about the tooth where any tartar could be found. This is the third case in my experience where teeth with every possible indication of ordinary abscess from a dead pulp have been found to have calcic abscesses. I have seen very little about this condition in dental literature.

Dr. McNaughton.—Dr. Kirk has recorded one case in his own mouth.

The President.—We will now pass to the reports of the standing committees. The first is the Committee on Operative Dentistry. Dr. Bogue, the chairman, is not present; but it is well understood, I presume, that members of the committees may make individual reports, and not depend wholly upon the chairman to make a report for the committee.

Dr. George A. Wilson.—Might I suggest, Mr. President, that Dr. Allan be called upon to report the result of the use of the cataphoric instrument in obtunding for the removal of a live pulp? I had an invitation, but was unable to witness the operation.

The President.—If Dr. Allan has anything of interest in regard to operative dentistry we will be pleased to hear it.

Dr. George S. Allan.—The case Dr. Wilson alludes to was a right superior lateral. The lady came to me with one of those hideous gold caps over the tooth, and wished to have it changed. On taking off the cap I found that the pulp was alive, and the crown badly decayed.

It was impossible to put a porcelain-faced crown on the root, owing to its prominence, without destroying the pulp, and there was every indication that the pulp had commenced to destroy itself. I applied citrate of cocaine with the cataphoric current, using eight or ten cells of the Van Woert apparatus. I continued the application for about fifteen minutes, and then, as it was getting late, I cut the operation short, although I felt quite certain that I had not obtained complete insensibility. I found that the pulp was so nearly insensible to pain that two-thirds of it was removed without the patient wincing or paying any attention to it. Then, rather than continue the operation, as the patient was tired and

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nervous, although she acknowledged she was not in pain, I applied a local obtundent and dismissed her until morning, when I finished the operation by the use of ordinary arsenical paste. Five minutes more of the cataphoric current would undoubtedly have produced complete insensibility, and the whole pulp could have been removed without pain. My success with the cataphoric current seems to me to be greater every day that I use it. I do not find as much use for it in obtunding sensibility as some others do. I have noticed one or two peculiarities: in one case I applied the current and the patient was delighted,—said she could come now to the dental office and not feel worried, all fear of the operations having been removed. At the next operation I supposed, of course, that she would want the cataphoric current; and she said, "Doctor, is it all ready?" To which I replied, "Yes, it is all ready." "Well," she said, "never mind; keep right ahead, and if necessary we will have it later." But, although she has had work done several times since, she has not found it necessary to have the cataphoric current. I think the moral influence, however, was very satisfactory.

While we are speaking of the cataphoric current I wish to exhibit this card of specimens, and at the same time request the secretary to read an article which has induced me to write to Dr. Bethel, and from whom I have obtained the privilege of exhibiting his specimens. The idea illustrated here is the use of the cataphoric current in forcing nitrate of silver into the dentine of the roots of dead teeth. The subject is exceedingly interesting, and the success that Dr. Bethel has met with, as exemplified in the specimens he has so kindly sent here for our examination, I think warrants my asking you to listen to this article. I will therefore call upon our secretary to read the article, and then exhibit the specimens for your examination.

The President.—Gentlemen, you will give your attention to this article presented by Dr. Allan.

The secretary read, from the *Dental Digest* for October, 1896, an article entitled "Lining Root-Canals," by S. P. Bethel, D.D.S., M.D., of Kent, Ohio; also a letter of Dr. Bethel to Dr. George S. Allan, explaining the exhibit of specimens.

Dr. Allan.—I wish to pass around this card of specimens that Dr. Bethel has so kindly sent me. I think it will pay all to examine them with the magnifying glass carefully, especially No. 4; and notice, also, in No. 2, which was operated on in the mouth, that the crown of the tooth is not discolored perceptibly; showing that

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there need be no disfigurement from the use of nitrate of silver. These specimens are very instructive as showing what the cataphoric current can do in this direction. I hope to carry on my correspondence with Dr. Bethel, and I feel very certain from the tone of his letters that he will give us the benefit of his future experiments. It will be noticed that the nitrate of silver has penetrated about one-thirty-second of an inch into the substance of the dentine, completely closing the mouths of the dental tubules and preventing the ingress of bacteria.

Dr. W. St. George Elliott.—I happened to be present when this paper was read, and in justice to the profession it appears to me that we ought to get at all sides of the story. The discussion, particularly the part taken by Dr. Taft and Dr. Abbott, was most interesting. While they did not deny the efficacy of the process, they contended that there were certain objections to it, and that precisely the same results could be obtained in the ordinary way; many dentists having used nitrate of silver for many years for that purpose.

Dr. Allan.—I have no objection to the discussion of this paper being read, if the members would like to hear it. I had not the slightest idea of preventing the other side from being heard, but to save time suggested the reading of the article itself.

The President.—Perhaps, as Dr. Elliott was there, he can give us some account of the discussion which may be sufficient for us.

Dr. Elliott.—Personally, I do not think that the opponents of Dr. Bethel made out a strong case. Dr. Abbott seemed to be opposed to cataphoresis in general Dr. Taft stated that in his own experience he found that the staining complained of was most superficial, and could be readily removed by scraping. This is not in accord with my own observation. While in London, I had a patient who had very protruding canines, and a dentist—I am sorry to say it was an American dentist—had treated the case in a very heroic manner, had excised a portion of the canines, ground off all the projecting portions, almost exposing the pulp in doing so, and naturally made the teeth exceedingly sensitive. He then applied nitrate of silver; and the teeth were very badly discolored when I saw the case five years afterwards.

Dr. C. B. Parker.—In relation to nitrate of silver; three weeks ago a physician came to my office suffering with a congested pulp. I removed the filling and applied the cataphoric current for thirty minutes, using cocaine, thinking that I could remove the pulp then, but I found it just as sensitive as ever; the cocaine apparently

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had not had any effect, and the man was suffering so intensely that for the moment I did not know what to do. I made up my mind that cocaine was not going to give me the result that I wanted, and I applied a solution of nitrate of silver, expecting only a temporary effect. I applied the current for six minutes. After two or three minutes he said the pain had subsided, but I thought I would continue it a few minutes longer. I did so, and after six minutes I tested the pulp, and was able to remove it completely without pain.

Dr. McNaughton.—What strength of nitrate of silver did you use?

Dr. Parker.—I make the saturated solution.

Dr. Elliott.—I would like to say that on theoretical grounds nitrate of tin would be preferable to nitrate of silver. Speaking of cataphoresis and cataphoric instruments, I have, like the most of us, paid a good deal of attention to the matter the last few months. My son has been connected with several of the companies, and has had a very extensive experience during the summer, making some two hundred and fifty demonstrations on patients, including pulp-extractions, and there were several interesting points brought out in his experience. One was the fact that cocaine is not to be relied upon when the solution is more than two days old. The second point was that eucaine is found to be in many cases preferable to cocaine; and a combination of eucaine and cocaine seems to be very efficient. Another point was that in single-rooted teeth the result is always more favorable. If the case is not successful it is probably owing to some defect in the insulator of the current.

With the molar pulps there is more difficulty. Of course, the current will not divide itself and pass down through the different roots of a tooth, but will naturally take the channel that has the least resistance; and the result is that one root may be anæsthetized, while the others are not, and the process has to be repeated, first passing the electrode down into the canal which is most accessible, and afterwards following with the others; and in that way it is perfectly successful.

Dr. Parker.—In over thirty attempts to remove pulps cataphorically, the one I have just referred to is the only one that gave me the slightest trouble, using a solution of cocaine, and that tooth had been giving the patient a great deal of pain for about ten days.

Dr. Allan.—Some time ago I saw an article on gold filling, with

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special points for hand-pressure. I think I had better read it hastily, and then pass around these instruments, so that all can see them and discuss their merits.

Dr. Allan read an article entitled "Gold Filling, with Special Points for Hand-Pressure," by A. D. Barker, D.D.S., of Grinnell, Iowa. Read before the Iowa State Dental Society, May 6, 1896.

Dr. Allan.—I have a set of points made on this same principle. The S. S. White Company now has the patterns in the Philadelphia depot, and they have kindly loaned them to me for your inspection. There is no doubt but what there is a principle involved in the shaping of these points, and I think a correct one. Take a round cavity and attempt to pack gold perfectly against the walls, with any but very fine points, and the result is that the gold will not be packed homogeneously. That is easily demonstrated. There is an old saying that one cannot put a round man into a square hole, and certainly one cannot pack gold into a round-shaped cavity with square-shaped plugger-points and have a perfect and uniformly condensed plug. The idea that Dr. Barker has is that the cavity, being shaped like the end of the finger, the filling-instrument should be of a similar shape, so that when the gold covers the point of the instrument the gold and the instrument will fit the wall and the gold be packed evenly at that point. The instrument being serrated, of course one gets the benefit of the mechanical principle of the wedge, as well as being able to use the points to burnish down the gold. I would like to call attention particularly to three forms, which please look at with the magnifying-glass. One is round ended and another is flat. The serrations in one case run lengthwise of the point, while in the second they are cut crosswise. The third is simply a fine burnisher. The handles are just large enough to fill the hand, and the short shank gives a power that one cannot appreciate without use. I think these instruments and the principle in them constituted are worthy of much attention.

Dr. Elliott.—Mr. President, it has been remarked that it frequently happens that inventions of the same general character are brought out by different men in different places at or near the same time. Dr. De Trey, an old friend of mine, recently brought out a set of instruments of the same general character as these exhibited by the last speaker. The details are not the same, but the principles involved are, and he considers them essential in the use of solila gold. I imported some during the summer, and also secured a copy of the American patent to find out what the gold really consisted

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of. As far as I could tell it is nothing more than mat gold; not deposited upon a sheet of foil, but merely mechanically locked into a sheet of foil. The objection to the S. S. White mat gold is the great waste in working: the pieces do not hang readily together in the continuous filling of a cavity. I am under the impression that De Trey's gold is practically the same thing. The crystals are finer, however, and seem to require less effort to condense. The principles adopted in filling are the same apparently as those introduced by Dr. Royce and subsequently by Dr. Barker.

Dr. Davenport.—Dr. J. F. Adams, of Worcester, Mass., has recently designed a chin-rest, and I have the principal parts here to exhibit to-night. The portion which I have not brought is the malleable iron socket which is attached to the chair, of no matter what make, by two screws running through the screw-holes already existing in the iron frame of the chair. The socket referred to receives this nickel-plated standard, and this standard, having a ball-and-socket joint, receives the main shank of the chin-rest proper. The portion of the apparatus upon which the patient's chin rests is secured by a ball-and-socket joint, and also has a covering, which can be made an air-cushion by the introduction of air. The two ball-and-socket joints and one single clamp make the apparatus almost universal in its application. I should like to say, Mr. President, that I have possessed one of these rests for several weeks, and while I have not used it many times, it always being difficult for me to adopt new appliances, it has been of distinct service in several cases where important and lengthy operations were being performed upon the lower teeth. There are some patients who, whether from age or nervousness, after sitting for a little time with all the paraphernalia that we subject them to in position, are troubled with a most disagreeable shaking or trembling of the lower jaw, which makes the operation much more difficult because of the lack of security and solidity of the object upon which we are working. Aside from the help in that way to the operator, this affords a distinct and comfortable rest for the patient. It is also of service when operating for young children, who very often exhibit a marked tendency to slip down upon the foot-rest. I should be very pleased to exhibit this instrument attached to the chair in my office.

Dr. Elliott.—Mr. President, I would like to make some remarks on the subject of mallets. Of course, we all have our opinions, and, unfortunately, we are too much given in public meetings to giving our opinions without giving the proof for the reason that is within

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us. In the matter of mallets there are a number of opinions, one operator preferring one kind and another preferring another. It seems to me that we are able to bring the question down to something like a scientific basis; there ought to be but one way of doing a thing, and that the best way, and the best way ought to be generally adopted. That leads me to remark that my own belief in the conservatism of the profession is so great that if there were demonstrated here, for example, a process of condensing gold which would meet every requirement, which would be scientific, accurate, and rapid, there would not be a single person who would adopt it, all continuing to do just as they had been doing. Years ago a gentleman in London said to me, "My process of filling with gold is exceedingly rapid; I use the hand-mallet and mallet for myself; I have a young lady assistant who conveys the gold, and I claim to be able to do work quicker than it can be done in any other way and equally well." I immediately challenged this gentleman to a trial test in filling. In the course of several weeks half a dozen other gentlemen joined us. Each operator had the choice of his own method, was to take his own time, and keep account of the time consumed, and to perform the operation in his own way. One malleted for himself, one had an assistant to mallet for him, there were three or four who used electric mallets, and one who used the pneumatic mallet. The operations were performed, of course, out of the mouth, and in similar cavities as far as possible to prepare them, cavities in molars that were made difficult of access by the presence of other teeth, all mounted in plaster. The teeth to be operated upon were prepared by a third person and given out by lot, and the operators returned the work performed to an umpire, who made a thorough examination of it. Tests were made of the surfaces for solidity, polish, homogeneousness as far as it could be recognized, the force with which the plug was held in the tooth, and for other points of more or less importance, and the curious fact which came out was that the shortest operation was performed by a man who malleted for himself. He took an hour and a half to perform the operation, while the one who had an assistant to mallet for him took an hour and three-quarters, and the electrics took about five hours each. (I have not the report by me.) The work performed by the electrics did not prove to be as good as that of the gentleman who had an assistant, and who took the prize. I merely mention this incident on account of the fact that there was not a single man, as far as I know, who changed his mode of operating as a result of the trial.

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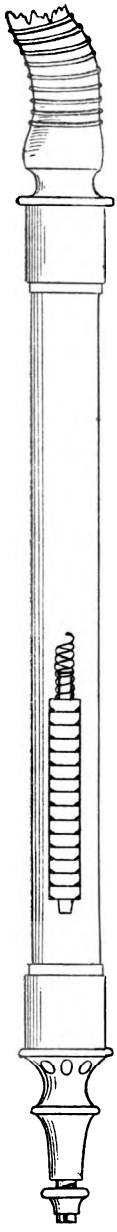
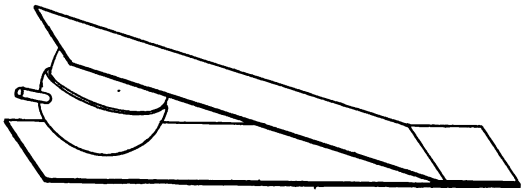
Fig. 1.



Now, in regard to mallets, I have made a series of experiments, with a view to getting some positive data in regard to the force required. I have made a number of forms of pneumatic mallets. This one was made in London, and carries a large flyer of considerable weight. Then I found that the majority of patients are somewhat curious to know what was the force used, how the gold was malleted by something which was inside. For the purpose of satisfying that curiosity I made it of glass (Fig. 1), recognizing the fact also that glass has a very material advantage in causing less friction. Then I had to get over the difficulty in connection with glass, the liability to breakage, and that I succeeded in overcoming by receiving the blow on a spring. I have reduced the bellows to its simplest form. (Fig. 2.) It con-

Fig. 2.



sists of two pieces of spring brass, two hemispheres, one passing inside the other, which is covered with rubber dam, held by a wire ring, which enables one to change it in a moment. I have used it for two years; the rubber has to be changed once in three or four months. The pneumatic mallet fills a certain field which is not filled by any other instrument. It does not compare, for instance, with the hand-mallet for universality. The class of cavities for which I prefer the pneumatic are those anterior cavities, in what are sometimes, but erroneously, called the oral teeth. There the pneumatic mallet seems to work with far more delicacy of force than any other; is even more delicate than hand pressure.

In some experiments that I have made in regard to the penetrating power of different forms of mallets, I found that by taking an ordinary automatic (Fig. 3),—the well-known Abbott instrument, for example,—the average force required to operate it was two and a half

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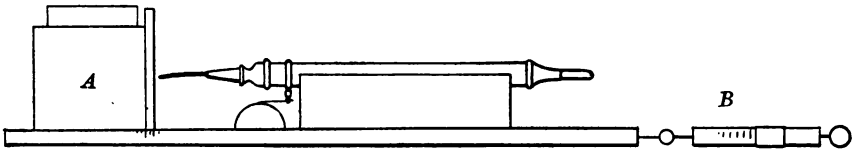
pounds. The efficiency of the blow is found by multiplying the weight of the hammer by the square of its velocity. The weight in this hammer is twenty-three grammes. By the use of a heavier

FIG. 3.



weight, whether it be a hand-mallet or an automatic mallet, the whole tooth must naturally be jarred; whereas with the light weight and high velocity its effect would be upon the surface of the gold and not through the body of the tooth.

If we are using soft foil the whole question is altered, as we then wish to produce an effect far beyond the surface. Many gentlemen, in speaking of the relative solidity of their work, say it is solid because it was reduced to a sheet of gold by hammering on an anvil or by rolling, forgetting the fact that it is the hammering or rolling that condenses it. The only way to test the solidity of a filling is by its specific gravity. This instrument has been designed to test the effect of different forms of blows. (Fig. 3.) *A* is an anvil weighing four and a half pounds. A pad of ten sheets of writing-paper is placed against it to receive the blow of the instrument to be tested. Using the same sharp point, it was found that with a pull on a spring-balance (*B*) of two and a half pounds the Abbott penetrated five sheets (flyer, twenty-three grammes) and moved the anvil block one-quarter of an inch, while the pneumatic with light flyer (three grammes) penetrated six sheets and failed to move the anvil even when reduced to two pounds. We are thus led to this conclusion, that in the anterior teeth, particularly when loose or painful in their sockets, it is best to use a small weight and high velocity, as it packs the gold better and does not disturb the tooth.

I have experimented a good deal with cataphoric outfits of various kinds. I prefer the street current to a battery, but must have it absolutely reliable, and believe I have accomplished it. An electrician of the Edison company was informed that the fluctuation of the current was not more than two volts in one hundred and eighteen on this section, which would make a very small change when only ten volts are being used.

As far as I know, none of the apparatus in present use will give steps of less than one-eighth of a volt. The Wheeler apparatus

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gives a change of one-fifth of a volt, and steps of this amount are liable to produce some sensation on the part of the patient.

I use the Willms controller, which has one hundred and eleven steps. I have had a special rheostat made. It gives five, ten, fifteen, twenty-five, thirty-five, and fifty volts, so that I can commence with five volts pressure, and in steps of one-twentieth of a volt gradually increase to fifty volts, if necessary. I take current off the main circuit with constant resistance by a shunt, pass it through the Willms milliampère metre, and thus practically get rid of any variation in the street current.

The President.—The Committee on Prosthetic Dentistry, Dr. Bishop, chairman, will now report.

Dr. J. Adams Bishop.—As the chairman of the Committee on Prosthetic Dentistry, I take great pleasure in submitting the following report:

The New York Institute of Stomatology, at its monthly meetings during the first year of its life, has had some rare cases presented to it, showing the results of treatment by mechanical dentistry or mechanical surgery, and it may be years before the like are presented again. Our report is only a review of the cases.

At the November meeting of 1895, Dr. C. O. Kimball reported and exhibited the cast of a case of fracture of the superior maxilla. Miss D., aged eighteen years, was struck with a golf-stick, breaking off the corners of two lower teeth, cutting through the upper lip, crushing in the left upper central and lateral teeth, and separating the two maxillæ at their anterior portion by nearly a line.

Owing, in part, to the extensive laceration of the lip, the jaw was not attended to until ten days after the accident. Then sectional impressions of the upper jaw were taken, the arch restored, and a splint made to fit the model.

The two sides of the jaw were drawn together and the splint applied, pushing out the left lateral and central teeth to their proper positions. Perfect union and firmness of teeth were secured, none of the teeth dying, but a slight permanent separation of the central incisors remained.

At the same meeting I had the pleasure of presenting a patient, the condition of whose mouth was the result of a sharp-pointed stick having been forced through the soft palate, displacing teeth and causing the loss of a portion of the superior maxilla, so that the mechanism of the mouth was greatly injured. The treatment was the same as for cleft palate.

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Getting a good impression of the mouth, and especially of the back molars, which would give a good support, I made a plate, covering the mouth and making it air-tight.

The result was most gratifying, especially to my patient. He goes down town to business and does not hesitate to come in contact with any one, as this plate gives him the natural use of his organs of speech.

At a meeting of this Institute held at the Polyclinic College, on February 4, 1896, Dr. Dawbarn gave a lecture and surgical demonstration, as reported in the INTERNATIONAL DENTAL JOURNAL for April, 1896. Dr. Dawbarn described to you the difficulties and the magnitude of the operation he had performed upon a patient whom he exhibited there, but his patient's life depended on his performing it.

The condition of this patient, after the removal of the superior maxilla of one side, was all favorable for a healthy recovery from the operation, after which the parts had to be restored by artificial means. To enable the patient to resume his daily occupation, his voice and looks were the two things to be considered first. A good impression was obtained, and a dental fixture covering the roof of the mouth and supplying the left half of the dental arch with teeth was made. The entire right side is embraced or clasped by the plate, which is so balanced that it is worn constantly with entire comfort and scarcely betrays its presence.

One of the very important departments of prosthetic dentistry is the making of metal dies. The swedging of gold or platinum plates is a delicate thing to do well. Suppose we have a patient who needs a gold plate for the superior maxilla, which means a suction plate. The impression with plaster is the first step. I prepare the mouth for the plaster by wiping off all the saliva that forms a covering over the mouth, really making it larger.

I find by so doing that my impression is so perfect that it is with difficulty I remove it. Then I proceed, using all the care I can so as not to have a blemish upon my cast. I give the impression two coats of varnish which, of course, makes the cast a trifle smaller. Trimming the plaster cast made from that impression down very thin, I fasten it into an iron cup, which is four inches in diameter and three inches high, leaving at least two inches for the metal, hereafter described. The metal is poured into this cup as soon as the plaster is thoroughly dry.

The plaster cast is perfectly dry if no moisture condenses on the face of a mirror held over it. The plaster cast will then receive

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the molten metal perfectly. As soon as the metal is in the cup, chill the iron cup with cold water on the outside, so as to induce the metal to concentrate around the plaster cast. The metal for this, the female die, is composed of about two-thirds tin and one-third lead. When cold it will readily come out of the cup, and should then be thoroughly cleansed, the plaster cast—for which there is no further use—being cut away.

It is then ready for the male die, which is made of fusible metal, one-half bismuth, one-quarter lead, and one-quarter tin, so that it melts at about the temperature of boiling water. An iron ring is placed upon the female die a little larger than the impression, and the fusible metal poured into that ring. This male die when cold will not stick, but will separate readily, and from the same female die I usually make three or four male dies, numbering them in their order as taken.

I begin swedging upon the one last taken, leaving the first male die, which is, of course, the most accurate for the final swedging.

This method, though possibly somewhat more laborious than some others, produces, in my opinion, emphatically, the most perfect results.

Adjourned.

S. E. Davenport, D.D.S., M.D.S.,
Editor of The New York Institute of Stomatology.

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